EMPHASIZING SCAPULAR MUSCLES FORCE COUPLE ACTIVATION AND CONVENTIONAL EXERCISES TO TREAT SCAPULAR DYSKINESIS IN SECONDARY SUBACROMIAL IMPINGEMENT SYNDROME ON REDUCING PAIN, DISABILITY INDEX AND FEAR AVOIDANCE BELIEFS.

-A Comparative study

Dissertation submitted to The Tamil Nadu Dr. M.G.R. Medical University towards partial fulfillment of the requirements of **MASTER OF PHYSIOTHERAPY (Advanced PT in Orthopaedics)** degree programme.

KMCH COLLEGE OF PHYSIOTHERAPY

(A unit of Kovai Medical Center Research and Educational Trust)

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CERTIFICATE

This is to certify that research work entitled **"EMPHASIZING SCAPULAR MUSCLES FORCE COUPLE ACTIVATION AND CONVENTIONAL EXERCISES TO TREAT SCAPULAR DYSKINESIS IN PATIENTS WITH SECONDARY SUBACROMIAL IMPINGEMENT SYNDROME"** was carried out by the candidate bearing the **Register No: 27140082**, KMCH College of Physiotherapy towards partial fulfillment of the requirements of the **Master of Physiotherapy (Advanced PT in Orthopaedics)** of The Tamil Nadu Dr. M.G.R. Medical University, Chennai-32.

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ABSTRACT

OBJECTIVES

❖ Emphasizing scapular muscles force couple activation and conventional exercises to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs

STUDY DESIGN:

❖ Quasi experimental study design.

STUDY SETTING:

❖ Outpatient department of KMCH hospitals, coimbatore.

SAMPLE SIZE&INTERVENTION:

❖ 30 individual with subacromial impingement syndrome who met the inclusion criteria were selected for the study.

❖ GROUP- A (experimental) : 15 individuals received scapular muscles force couple activation exercises

❖ GROUP- B (control) : 15 individuals received conventional exercises

OUTCOME MEASURE:

❖ Pain status

❖ Disability index

❖ Fear avoidance belief level

MEASUREMENT TOOLS:

❖ Shoulder pain and disability index

❖ Fear avoidance belief questionnaire

RESULTS&CONCLUSION:

The data were analyzed using paired, and independent 't' tests at 5% level of significance. the scapular muscles force couple activation exercises group showed a greater improvement when compared with the conventional exercises group.

The results of this study concluded that scapular muscles force couple activation is more effective for subacromial impingement syndrome individuals.

KEYWORDS:

Subacromial impingement syndrome, scapular dyskinesis, force couple activation, shoulder pain and disability index.

1. INTRODUCTION

Shoulder impingement syndrome is a common musculo skeletal disorder which is a broad term of mentioning the shoulder pain. According to the site and etiology of the pain, anatomical variations, mechanical loading disturbances and muscle imbalance involvement, clinicians subdivided or categorised the shoulder impingement syndrome into subacromial or external impingement; internal impingement that is divided into anterior and posterior and coracoid impingement.

The sub acromial or external impingement syndrome is further divided into primary subacromial impingement syndrome typically seen in older population results from physical narrowing of the subacromial space and commonly caused by rotatorcuff or bursal fibrosis, corocoacromial arch calcification, hooked acromian, bone spur development, distal clavicle or acromio clavicular joint degeneration, whereas more recently the secondary shoulder impingement syndrome is the result of functional narrowing of sub acromial space, common in younger population resulting in scapulo thoracic muscle weakness, posterior capsule tightness, gleno humeral instability hence results in the lack of scapular stability that contributes to the secondary sub acromial impingement syndrome.

The maintenance of normal scapulo humeral rhythm is essential in patients with shoulder impingement syndrome in order to attain complete range of motion despite of pain for performing functional activities and to prevent secondary complications that may lead to contracted shoulder capsule which either worsen the condition and pave path for another shoulder pathologies such as shoulder or adhesive capsulitis or frozen shoulder.

The scapulo humeral rhythm essentially serves for at least two purposes:

1. Presentation of the length – tension relationships of the gleno humeral muscles; the muscles do not shorten as much as they would without the scapular upward rotation and so they can sustain their force production through a larger portion of range of motion.
2. It prevents impingement between the humerus and the acromion.

The scapulo humer rhythm is maintained by the production of the force couple initially in the gleno humeral abduction by the force couple of the rotatorcuff and deltoid; upward rotation of the scapula by the production of the force couple of serratus anterior and trapezius muscles, hence it occurs in the ratio of 2:1 that is 2 degree of gleno humeral motion for every one degree of scapulo thoracic motions. Theoritically patients with the gleno humeral pathologies often exhibit inhibitions or imbalance within the scapular muscles in both static and dynamic activity of the gleno humeral joint that finally results in the scapular dyskinesis.

Scapular dyskinesis is a generalised term that defines the loss of scapular control and motions due to the imbalance or fatigue or weakness or abnormal firing of the motor neurons of the scapulo thoracic muscles. The scapula muscles are divided into two broad categoires viz; the scapulohumeral muscles that comprises of supra spinatus, infra spinatus, teres minor, sub scapularis (SITS) and deltoid and the scapulothorcic muscles that consists of the serratus

anterior and trapezius (the major stabilisers of scapula on thorax) and rhomboids, levator scapulae and pectoralis minor muscles.

Altered muscle balance such as upper trapezius over compensation or hyper activity and variable (timing) or insufficient (reduced amplitude) middle trapezius, lower trapezius, serratus anterior activity occurs in individuals with secondary sub acromial impingement syndrome.

The rehabilitation protocols to treat the secondary subacromial impingement syndrome abundantly dependent on directly targeting the scapulohumeral muscles by the range of motions, stretching and rotatorcuff strengthening exercises. The compensatory or affected normalized pattern of movements that occurred at the scapulothoracic joint is left untreated in individuals with secondary subacromial impingement syndrome. To elicit the complete shoulder abduction, as per the scapulohumeral rhythm theorized the scapula muscle activation is essential to elicit the functional activities despite of pain in individuals with secondary subacromial impingement syndrome.

The force couple activation directly targets the coordinated, synchronized activation of the muscles that compose the scapular upward rotation force couple for stabilization and a well co-ordinated elicitation of the scapulohumeral rhythm. The exercises focus on upward rotation force couple by increasing strength, promoting proper firing between muscles of force couple by directly targeting the activation of lower trapezius, middle trapezius and serratus anterior while simultaneously minimizing the activation of upper trapezius.

1.1 NEED FOR THE STUDY

Shoulder impingement syndrome consists of various rehabilitation protocols that includes the manual therapy, thermotherapy, cryotherapy, hydro therapy, exercise therapy and reported better outcomes with evidences. Improving the functional activities of the patients with secondary subacromial impingement syndrome is challenging with the conventional exercise programs that directly targets the affected structures (rotator cuff tendons) and the outcomes are not sound valid for prolonged benefits since the core etiology is not treated.

Electro myographic studies focuses on activating the upward rotators of the scapula in populations such as overhead throwers, althletes, sportsmen and healthy individuals. Studies that included the patients with shoulder impingement syndrome, provided results that are mixed with the activation of both scapulohumeral and scapulothoracic muscles and so investigating the effects of isoloated scapulothrocic muscles force couple muscle activation mechanism may provide a essential information on strength, applicability and importance of serratus anterior, trapezius muscle in the prognosis of the patients with secondary subacromial impingement syndrome.

The effects of isolated activation of scapular stabilizers had been proven already in both the normal healthy sportsmen and also patients with impingement syndrome and other shoulder pathologies. Force couple activation of the scapular retractors and upward rotators when together done it might produce better outcome since it acts in the anatomical movement pattern. Hence emphasizing the force couple activation is patients with scapular dyskinesis in secondary subacromial impingement syndrome might produce amazing outcomes when comparing with the conventional protocols that are targeted on the improving range of motion and muscle power whereas, the experiment induces the simultaneous recruitment of both essential muscles that are weak.

1.2 AIMS AND OBJECTIVES

1.2.1 AIM OF THE STUDY

The aim of the study is to identify the effects of emphasizing the scapular muscles force couple activation and conventional exercises to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.

1.2.2 OBJECTIVES OF THE STUDY

- To study the effects of emphasizing force couple activation of scapular muscles to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
- To study the effects of conventional exercises to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain disability and fear avoidance beliefs.
- To compare the effectiveness of emphasizing scapular muscles force couple activation and conventional exercise to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
- To identify and conclude the best approach in treating the scapular dyskinesis in patients with secondary subacromial impingement syndrome on reducing pain, disability index, fear avoidance beliefs and implement in the current clinical practice.

2. REVIEW OF LITERATURE

2.1 Shoulder impingement syndrome

Louis U Biglani William et al in 2010 reviewed the current concepts in subacromial impingement syndrome the review classified the etiological factors of subacromial impingement syndrome as intrinsic and extrinsic factor. It briefly explained the various stages of impingement evaluation and diagnosis with conservative and various surgical approaches of the shoulder impingement syndrome

Wing Kchang MD et al in 2004 explained the functional anatomy, sports-specific biomechanics, causes, physical examination, differential diagnosis, rehabilitation and prognosis of the impingement syndrome. The study concluded that impingement syndrome can e treated either conservatively/surgically. Accurate diagnosis and adequate treatment based on history, physical examination and appropriate diagnostic testing yields good prognosis.

2.2 Association between shoulder impingement syndrome and scapular dykinesis

Clinical implications of scapular dyskinesis in shoulder injury: the 2013 consensus statement for scapular summit

W Ben Kibler Et All, conducted a consensus conference on the scapula to discuss the accumulated knowledge regarding the scapular involvement in various shoulder injuries and the major conclusions of the conference were 1. Shoulder impingement symptoms are particularly affected by the scapular dyskinesis. 2. Rehabilitaiton programmes to restore scapular position and motion can be effective for better prognosis of shoulder impingement syndrome.

Shoulder Impingement : Biomechanical considerations in rehabilitation
Paula M Ludewig Et All published a manuscript that discusses the biomechanical aspects of shoulder joint and shoulder impingement syndrome relationship. They also presented 2 case examples and discussed the application of coupled interactions and potential mechanisms of movement abnormalities in targeting treatment intervention for movement based subgroups of impingement patients.

2.3 Effects of conventional exercises in shoulder impingement syndrome

Jeffry A Fleming et al in 2010 compared the interventions like manual therapy, exercises with other treatment for the rehabilitation of shoulder impingement syndrome. The study reviewed level I and II randomized controlled trial to form the components of the physical therapy programs used in each study. Findings from these reviews indicate that exercise is effective for pain reduction and improving function in subjects with impingement syndrome.

John H Kuhn et al in 2008 developed evidence based protocol and evaluated the effects of therapeutic exercises for shoulder impingement syndrome. 11 RCT studies are analysed for clinical and statistical significance of exercise program of in shoulder impingement. This systemic review suggests strong recommendation for exercises in reduction of pain, improvement in function but not in range of motion. Data reviewed in this study can be used in the design of standard exercise protocol for shoulder impingement syndrome.

Philip W Mcclure et al in 2004 conducted a study to examine the exercise program in patients with shoulder impingement syndrome. The purpose of their study was to identify the changes that might occur in 3-dimentional scapular kinematics, physical impairements and functional limitations. 59 patients with shoulder impingement syndrome were recruited and 39 patients successfully completed the 6 week rehabilitation program and follow-up testing. The study concluded that use of exercise protocol in the management of shoulder impingement syndrome have positive impact on patients impairments and functional limitations.

2.4 Effects of treating scapular dyskinesis

Baskurt Z et al in 2011 conducted a study to investigate the effectiveness of stretching, strengthening exercises and the scapular stabilization exercises on the pain, shoulder range of motion, muscle strength, joint position sense, scapular dyskinesis in patients with impingement syndrome. Lateral scapular slide test, western Ontario rotator cuff index were evaluated before and after treating and result suggested that for the treatment of impingement syndrome, scapular stabilization exercises given with stability and stretching exercises can be more effective in increasing the muscle strength and decreasing the scapular dyskinesis.

Effects of scapular function training and chronic pain in the neck or shoulder region: Randomized controlled trial, **Christoffer H. Anderson** (2013) Et All conducted a study to investigate intensive scapular function training in terms of training lower trapezius and serratus anterior muscles while minimising direct training of the upper trapezius was found effective in decreasing pain in neck or shoulder region and pressure pain threshold in lower trapezius where the scapular functional training was compared with control group. The

Scapular function training reduced pain intensity and increases shoulder elevation strength in adults with chronic non-specific pain in neck or shoulder region

Laura Schmitt MSPT et al in 1999, came out with a case report in which he found that the scapular winging began at the onset of shoulder elevation and also a frank serratus anterior weakness represents the scapulo thoracic instability. It suggest that appropriate timing and function of the force couple between serratus anterior and trapezius need to occur to avoid impingement of rotator cuffs and bursa in subacromial space it was concluded with that treatment should be given to weak muscles and not substitute with strong muscles resulted in a rapid return of the function

F.Struyf et al in 2012 conducted a study in which the impingement syndrome was treated with the scapula focused treatment and compared with the conventional therapy. The scapular focused treatment includes exercises of stretching, scapular motor control training. A large clinically important treatment effect in favour of scapular motor control training was found in a self-reported disability and effect were maintained at 3 months follow-up.

2.5 Effects of functional rehabilitation exercises targeting the force couple activation

Scapular muscles activation ratios in patients with shoulder inuries during functional shoulder exercises

Chad R Moeller MS (2014) Et All conducted a study to determine scapular muscle activation ratio and individual muscle ratio activity of UT, SA, LT and MT with GH injury and health control participants. They found high activation ratios during the external rotation with scapular squeeze exercises in serratus anterior and bow and arrow exercises in MT and LT/

Electromyographic activity of scapular muscles during diagonal patterns using elastic resistance and free weights.

Dexter Witt PT, DPT (2011) Et All conducted a EMG study to identify the muscle recruitment in various diagonal PNF patterns of upper limb such as D1 flexion, D2 flexion, D1 Extension, D2 extension with a elatic resistance and free weights. Studies shows a significant increase in MT, LT recruitement in D2 flexion patterns were SA was significantly remaining same in all patterns.

2.6 Special tests for shoulder impingement syndrome

Robert H.Hawins in 2001 for clinical assessment of the shoulder uses the following test to determine shoulder impingement syndrome. Forced forward elevation, or the neer sign and then forced internal rotation test or Hawkins sign and the third test was the painful arc sign or was an active abduction motion against light resistance. The patient with shoulder impingement syndrome reproduced pain in one or more above tests.

Hegedus EJ in 2006 done a study on the diagnostic accuracy of individual orthopaedic physical examination and revealed that the pooled sensitivity and specificity for the neer test was 79% and 53%, respectively, and for the Hawkins-Kennedy test was 79% and 59% respectively.

Michener LA in 2008 conducted a prospective, blinded study; the main objective of the study was to investigate the reliability and diagnostic accuracy of individual tests and combination of tests for subacromial impingement syndrome (SAIS). 55 participants were included in the study. Patients were evaluated with 5 physical examination tests for SAIS: Neer, Hawkins-kennedy, painful arc, jobe empty can and external rotation tests. Surgical diagnosis was the reference standard. From this study they found out that out of neer impingement test, Hawkins-kennedy test, painful arc test, empty can test, external rotation resistance test, cut point of 3 or more positive of 5 tests can confirm the diagnosis of SAIS, while less than 3 positive of 5 rules out SAIS.

2.7 Identifying scapular dyskinesis

Philip McClure et al in 2009, conducted a study to find a clinical method for identifying scapular dyskinesis on 142 atheletes who used over head arm motions. Videotaping was done from posterior aspect in bilateral weighted shoulder flexion and frontal plane abduction. Scapular dyskinesis was detected y a self-instructioanl format with standardized definitions and video taped example of normal and abnormal motion. The study concluded with the scapular dyskinesis that was defined as the presence of either winging or dysrhythmia with reliability that was calculated with weighted kappa coefficient.

Kibler et al in 2002, conducted a reliability study for testing the intra rater and inter rater reliability of clinical evaluation system for scapular dysfunction. Blinded evaluators were familiarized with the evaluation method of scapular movement pattern before viewing a videotape of 26 subjects with and without scapular dyskinesis. Reliability was assessed by a kappa coefficient. Inter rater reliability was found slightly lower than the intra rater reliability. The results indicate that, the qualitative evaluation method allowed clinicians to standardize the categorization of dynamic scapular dysfunction pattern.

Michener et al in 2006, conducted a study to compare 3-dimentional scapular kinematics, shoulder range of motion, muscle force and posture in 45 subjects with and without impingement syndrome. The range was assessed goniometrically and force by dynamometer and shoulder kinematics was analysed by the electromagnetic motion analysis system. The impingement group demonstrated less range and force in all directions when compared with the control group. The study concluded that the kinematic difference found may represent scapulothoracic compensatory stratergies for the gleno humeral muscle weakness.

2.8 Scapular reposition test

Effects of scapular reposition test on shoulder impingement symptoms and elevation strength in overhead athletes.

Angela. R. Tate PT, Phd (2008) Et All conducted a 2-group, repeated measure study to determine whether manually repositioning the scapula using SRT reduce pain and increase shoulder elevation strength in athletes with and without SI symptoms. 142 athletes were tested with manual repositioning of scapula in retraction, shoulder elevation was measured with mounted dynamo meter and the conclusion was the SRT is a simple clinical test that may be useful in an impairment based classification approach to SIS.

2.9 Shoulder pain and disability index (SPADI) and Fear Avoidance Belief Questionnaire (FABQ)

Thilo O Kromer et al in 2010, conducted a randomized controlled study to found the effectiveness of individualized physiotherapy on pain and functioning compared to a standard exercise protocol in patients presented with clinical signs of subacromial impingement syndrome, where they used SPADI for evaluating the pain and disability and FABQ to evaluate the level of fear in these patients before and after the treatment.

MacDermid J et al in 2006, conducted a study on the shoulder pain and disability index demonstrates factor, construct and longitudinal validity in which it showed valid and high responsivity in assessing the pain and disability.

Waddell et al in 1993, conducted a study on a fear-avoidance beliefs questionnaire FABQ) and the role of fear-avoidance beliefs in pain and disability and the findings are incorporated into a biopsychosocial model of the cognitive, affective and behavioural influences in pain and disability.

Cloke DJ et al in 2005, conducted a comparitive study between functional and patient-based scores in subacromial impingement in which they used the SPADI questionnaire as the main outcome measure and hence it is highly recommended for the use in patients with shoulder impingement syndrome.

Williams JW et al in 1995 conducted a study, 'measuring shoulder function with the shoulder pain adn disability index in which they concluded as a minimum improvement in the total SPADI score of 11 points will e considered as a minimum clinically important change.

Starkle R et al in 2007, conducted a study to investigate the psychomeytric properties and predictive power in a sample of swiss-german low back pain patients. The cross cultural german adaptation of the Fear Aoidance Belief Questionnaire was very successful and yielded psychometric properties and predictive powers of the scale. They concluded as the inclusion of the FAB as predictor variable in studies is highly recommended as they appear to have unique predictive power in analysis of the disability and work loss.

Pfinsten M et al in 2000, conducted a study to analyse the validation of the german version of the FABQ on 302 low back pain patients and they concluded that the scale has been proven to identify patients with maladaptations beliefs which had to be focused on in proper treatment.

3. METHODOLOGY

3.1 Research Design:

Pretest-Post test study design

3.2 Sampling Technique:

Purposive sampling technique

3.3 Study Population:

Outpatients of Orthopedic department of KMCH, Coimbatore.

3.4 Sample Size:

30 samples with 15 in each group
Group A (force couple activation ex's -Experimental): 15
Group B (conventional ex's- Control): 15

3.5 Study Setting:

Physical Therapy Department, KMCH, Coimbatore.

3.6 Study Duration:

4Weeks

3.7 Study criteria

- 3.7.1 Inclusion criteria:

1. Age : 30 to 70 years
2. Gender : both males and females
3. If patients have 2 out of following 5 criteria such as
   - ✓ Positive neer sign
   - ✓ Positive hawking sign
   - ✓ Positive jobe sign
   - ✓ Positive relocation test
   - ✓ Pain with apprehension
4. Positive Scapular Assistance Test (SAT) /Scapular Reposition Test (SRT)
5. Type-1 dyskinesis of scapula
6. Visual analog scale on pain should be less than 7 out of 10 at rest.
7. Range of motion should be greater than 130 degree of abduction which is necessary for muscle testing.
8. Dominant hand

- 3.7.2 Exclusion Criteria:

1. Previous or existing history of:
   Shoulder subluxation, dislocation, Complete rotator cuff tears
2. History of systemic or neurological diseases
3. Cervical radiculopathy
4. spinal deformities, fractures
5. positive speed's or yergason test
6. Generalized myalgia
7. Existing malignancy
8. Upper limb DVT
9. Recent Steroid and/or anti analgesic injections
10. Patient undergoing other physiotherapy treatment or chiro practic treatment for shoulder, neck, upper back in last two months
11. Cardio vascular diseases (Hyper tension, severe MI)

3.8 HYPOTHESIS

- Null Hypothesis:
  - H_{01}- There is no significant effects of emphasizing scapular muscles force couple activation to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
  - H_{02}- There is no significant effects of conventional exercises in treating scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain disability index and fear avoidance beliefs.
  - H_{03}- There is no significant difference between emphasizing scapular muscle force couple activation and conventional exercises in treating the scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.

- Alternate Hypothesis:
  - H_{A1}- There is a significant effects of emphasizing scapular muscles force couple activation to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
  - H_{A2}- There is a significant effects of conventional exercises in treating scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
  - H_{A3}- There is a significant difference between emphasizing scapular muscle force couple activation and conventional exercises in treating the scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.

3.9 OUTCOME MEASURES

1. Shoulder Pain and Disability Index (SPADI)
2. Fear avoidance belief questionnaire (FABQ)

3.10 MATERIALS USED:

(a) Plinth
(b) Exercise Pamphlet
(c) Goniometer
(d) Inch tape

3.11 PROCEDURE

In this study 30 patients diagnosed with shoulder impingement syndrome were divided into the experimental group (A) and the control group (B) Pain, disability, level of fear were assessed using the shoulder pain and disability index (SPADI) and the fear avoidance belief questionnaire (FABQ). Force couple activation exercises along with conventional exercises were given to the experimental group (A), where as control group (B) received only the convention exercises for 4 weeks. At the beginning of the study both the groups received the postural education and activity modification instructions. After 4 weeks the subjects were re-assessed using the SPADI and FABQ. Prior to the participation all the subjects were informed about the nature of the study and signed a consent form.

3.11.1 TREATMENT PROTOCOL

EXPERIMENTAL GROUP-A (force couple exercises)

a) Flexibility facilitation exercises:

1. cervical side bending (for upper trapezius)

Positon: standing
Instructions: side flex the neck to the opposite side. Rotate the head towards the same side

2. Scapular protraction (for rhomboids)

Position: sitting
Instructions: place the hands crossed over the table. Reach for maximum lateral directions

3. Shoulder horizontal adduction (for posterior capsule)

Position: standing
Instructions: bring the arm cross to the body. Use the other hand to apply over pressure, pulling the elbow

4. Shoulder horizontal abduction (for pectoralis major)

Position: stand over a corner of the wall
Instructions: place the hands over the wall with the chest inbetween the hands
Propel the chest forward with feets stable on the ground

Each exercises are done with 15 seconds stretch period, 3 secs rest and 3 repetitions bilaterally. 2 sessions/day for 4 weeks.

b) Scapular upward rotator force couple exercises

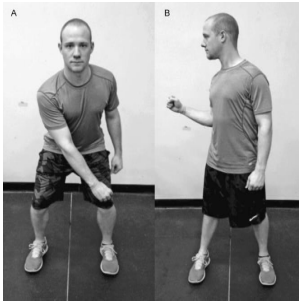
1. Bow and Arrow exercise

Position: Standing
Instruction: Raise the arm upto shoulder level. Pull one of the hand behind and other hand with extended position and vice versa

2. External rotation with scapular squeeze exercise

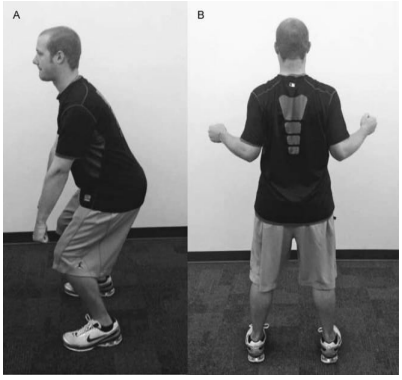
Position: Standing
Instruction: Flex your elbow with fisting. Move the hand in the outer direction. Do it alternatively in both hands.

3. Lawnmower exercise



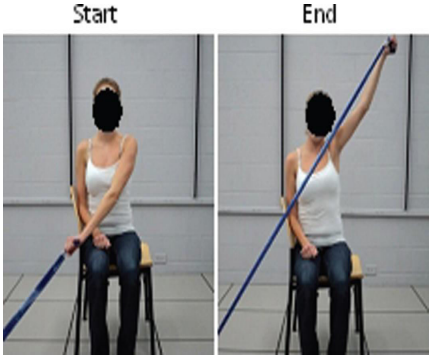
Position: Standing
Instruction: Flex your elbow with fisting. Extend it by using the body with bending then trunk forward. Bring back the hand to flexed position by twisting the trunk. Do alternatively in both hands

4. Robbery exercise



Position: Standing
Instruction: Flex your elbow with shoulders retracted. Extend it infront of your body with bending the trunk forward along with semi squatting. Bring back the hands to flex position with erect standing

5. D2 flexion pattern exercise

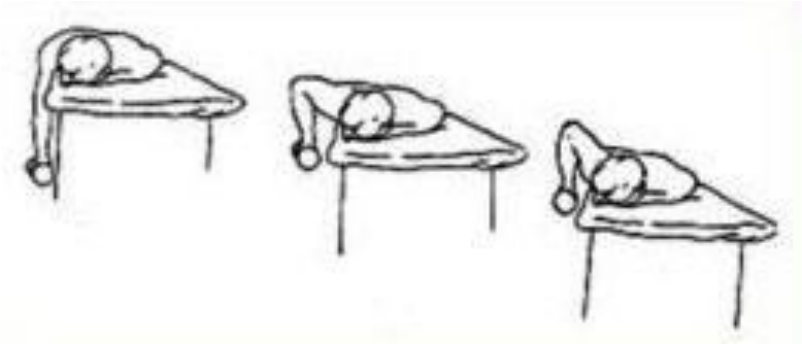


Position: Standing
Instruction: Bring the arm to the opposite side lower end. Make a cross movement by taking it to the same side upper end. Do it alternatively

6. Scaption plane elevation

Position: Standing
Instruction: Flex the arm forward with palms facing towards the opposite palm. Raise the arm upto the maximum level. Do it alternatively.

7. **Prone lying rowing**



Position: Prone lying
Instruction: Lye down at the edge of the couch. Hangdown the treatment hand at the edge. Now pull the hand from down to up with shoulders retracted.

Each exercise is performed with voluntary contraction by the patient despite of pain. 10 repetitions for each exercises that are simultaneously in bilateral limbs with 3 secs rest period in between each exercises

CONTROL GROUP-B (conventional exercises)

a) Flexibility facilitation exercises

1. Cervical side bending (for upper trapezius)
2. Scapular protraction (for rhomboids)
3. Shoulder horizontal adduction (for posterior capsule)
4. Shoulder horizontal abduction (for pectoralis major)

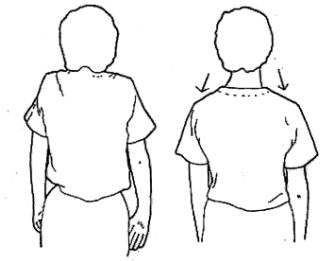
Each exercises are done with 15 seconds stretch period, 3 secs rest and 3 repetitions bilaterally. 2 sessions/day for 4 weeks.

b) Range of motion exercises

1. **Codman's pendular exercise**

Position: Stooped standing
Instruction: Bend down with the arm hanging freely. Make small-large circles with the hand in clock-wise and anti-clockwise directions.

2. Shoulder shrugging exercises



Position: Standing
Instruction: Leave the arm free and relaxed. Try to pull the shoulder blades to touch the ears and then relax.

3. Active shoulder joint movements

Position: Standing
Instruction: Raise your arm in the forward, sideward and backward directions respectively until full range. Twist the arm in and out such that pouring water in a glass

4. Seated dips

Position: Sitting
Instructions: Hold the arm rest of the chair. Try to get down from the chair without taking the hands off from it

3.11.2 TREATMENT DURATION

- The intervention duration was 4 weeks in which the patient performed the exercises actively.
- FREQUENCY: Once a day within 30-40 minutes.
- REST INTERVAL: The patients were asked to perform deep breathing twice during the carryover from one exercise to another and also during the exercises, to avoid the breath holding.
- SPEED: The patients did the exercises at a self selected, comfortable pace.

3.12 PHOTOGRAPHIC REPRESENTATION

3.12.1 Rhoimboids stretching

3.12.2 Posterior capsule stretching

3.12.3 Pectoralis major stretching

3.12.4 Prone lying rowing

3.12.5 Scaption plane elevation

3.12.6 External squeeze exercise

3.12.7 Robbery exercise

3.12.8 Landmover exercise

3.12. 9 Bow and Arrow exercise

3.12.10 Codman's Pendular exercises

3.12.11 Seated dips

3.12.12 Biceps Curls exercise

3.31 STATISTICAL ANALYSIS

DATA ANALYSIS:

1) PAIRED 't' TEST:

$$S = \sqrt{\frac{\Sigma d^2 - (\bar{d})^2 \text{ x } n}{n-1}}$$

$$t = \frac{\bar{d} \text{ x } \sqrt{n}}{S}$$

n = Number of sample

$\bar{d}$ = Mean of Deviation

$\sum d^2$ = Sum of Squared Deviation

2)INDEPENDENT 't' TEST:

$$S = \sqrt{\frac{\Sigma(x_1 - \bar{x}_1)^2 + \Sigma(x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

$\bar{X}_1$ = Mean of group A

$\bar{X}_2$ = Mean of group B

n_1 = Number of sample in group A

n_2 = Number of sample in group B

Level of significance is 5

4. DATA PRESENTATION

4.1 **TABULAR PRESENTATION**

TABLE-4.1.1.1

PAIRED ‘t’ test - SPADI (A)- Experimental group (force couple activation exercises)

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Pre Test	Post test			
SPADI (A)	638.4	334.52	37.67	2.145	0.05

TABLE-4.1.1.2

PAIRED ‘t’ test - SPADI (B)- Control group (conventional exercises)

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Pre Test	Post test			
SPADI (B)	608.4	491.41	14.35	2.145	0.05

TABLE-4.1.1.3

PAIRED ‘t’ test - FABQ (A)- Experimental group (force couple activation exercises)

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Pre Test	Post test			
FABQ (A)	871.17	524.05	14.47	2.145	0.05

TABLE-4.1.1.4

PAIRED ‘t’ test - FABQ (B)- Control group (conventional exercises)

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Pre Test	Post test			
FABQ (B)	845.4	560.51	10.38	2.145	0.05

TABLE-4.1.1.5

INDEPENDENT ‘t’ test – pretest for SPADI

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Group A	Group B			
Pretest values of SPADI	638.4	608.4	1.25	2.048	0.05

TABLE-4.1.1.6

INDEPENDENT ‘t’ test – post test for SPADI

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Group A	Group B			
Posttest values of SPADI	334.52	491.41	11.17	2.048	0.05

TABLE-4.1.1.7

INDEPENDENT ‘t’ test – pretest for FABQ

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Group A	Group B			
Pretest values of FABQ	871.17	845.4	0.68	2.048	0.05

TABLE-4.1.1.8

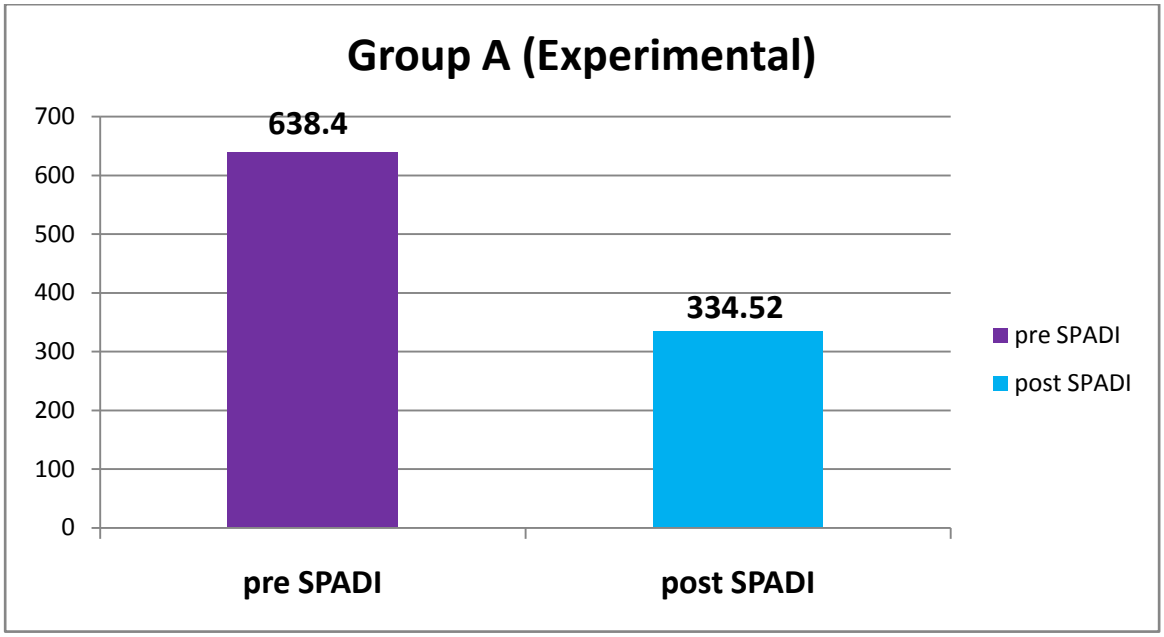
INDEPENDENT ‘t’ test – post test for FABQ

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Group A	Group B			
Posttest values of FABQ	524.05	560.51	1.61	2.048	0.05

4.2 GRAPHICAL PRESENTATION

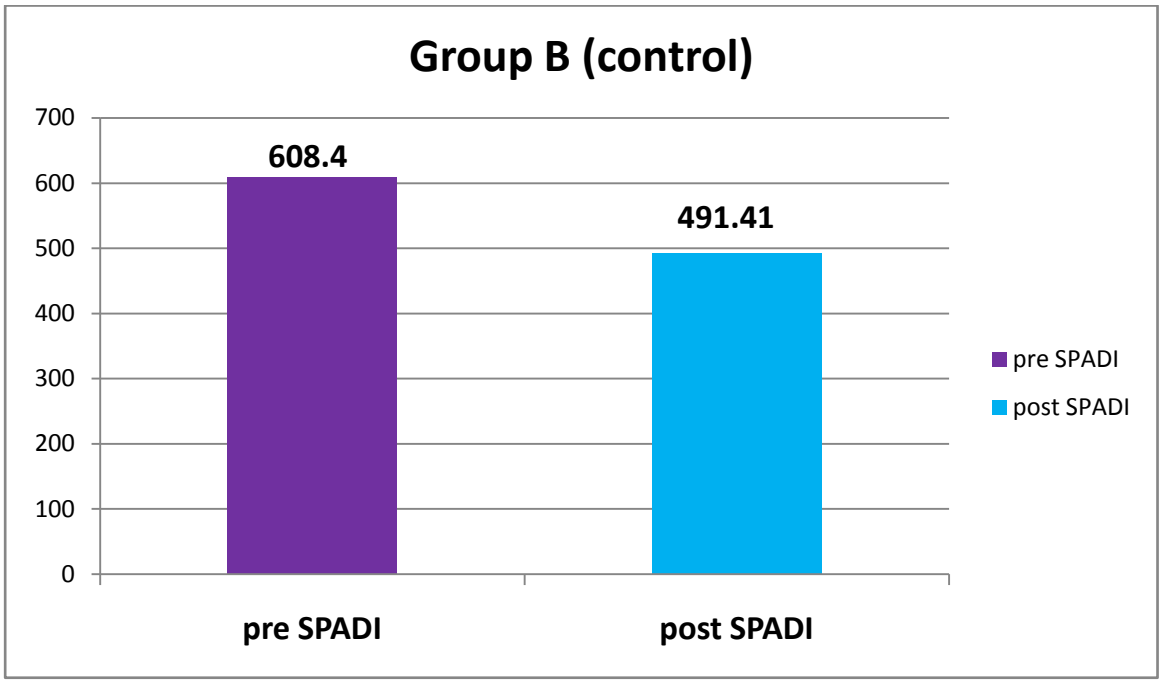
GRAPH- 4.2.1_Mean of pre test and post test values of SAPDI of Group A

PAIRED 't' test - SPADI (A)- Experimental group (force couple activation exercises)



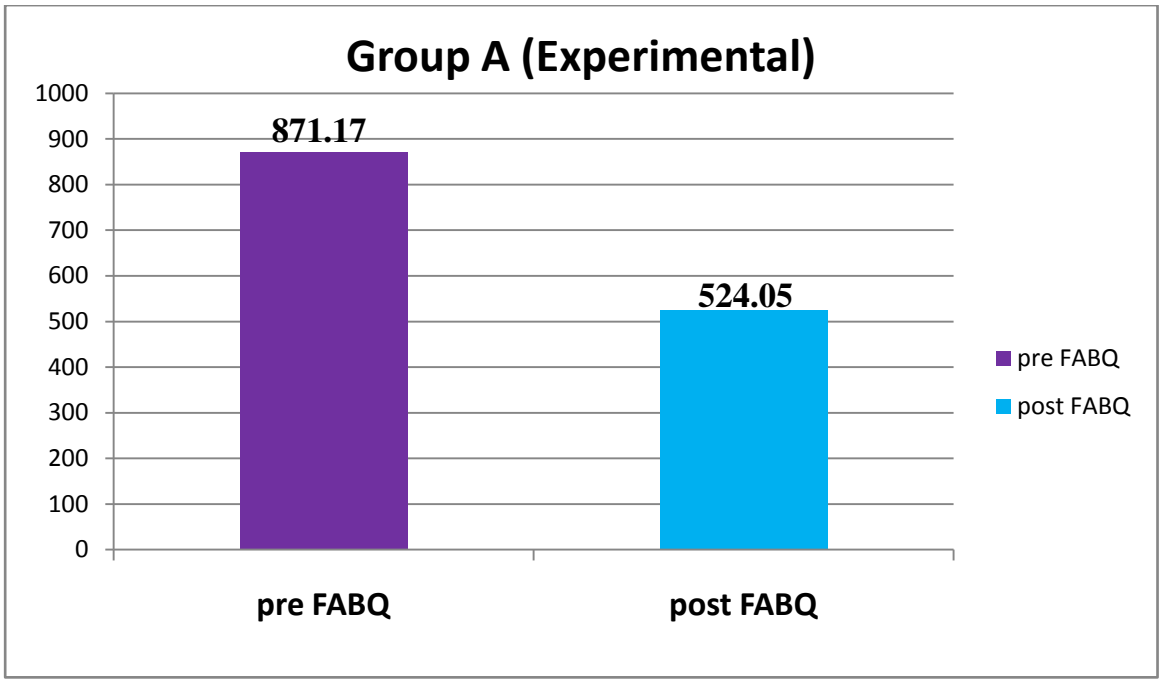
GRAPH- 4.2.2 Mean of pre test and post test values of SAPDI of Group B

PAIRED 't' test - SPADI (B)- Control group (conventional exercises)



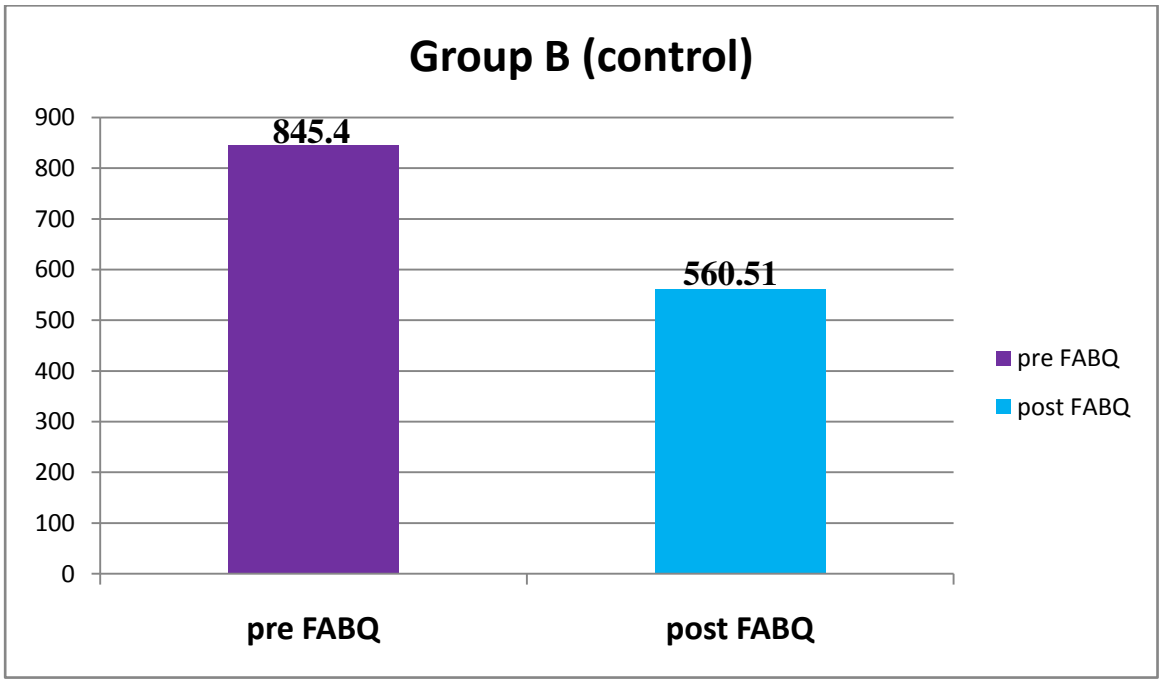
GRAPH- s4.2.3 Mean of pre test and post test values of FABQ of Group A

PAIRED 't' test - FABQ (A)- Experimental group (force couple activation exercises)



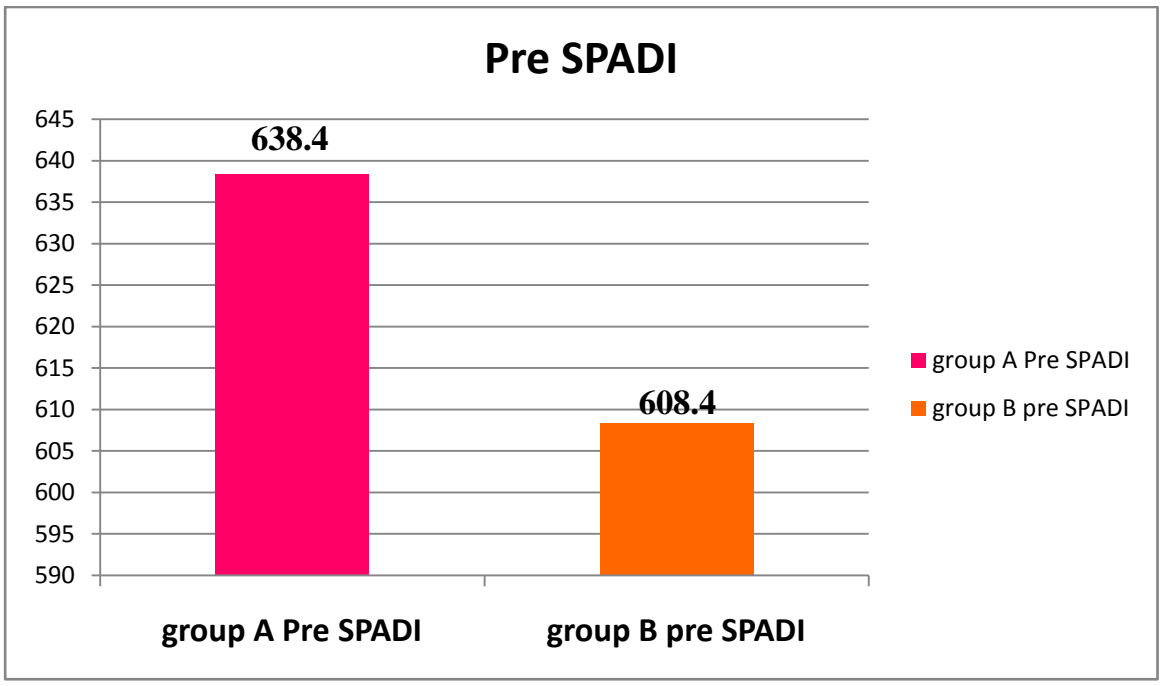
GRAPH- 4.2.4 Mean of pre test and post test values of FABQ of Group B

PAIRED 't' test - FABQ (B)- Control group (conventional exercises)



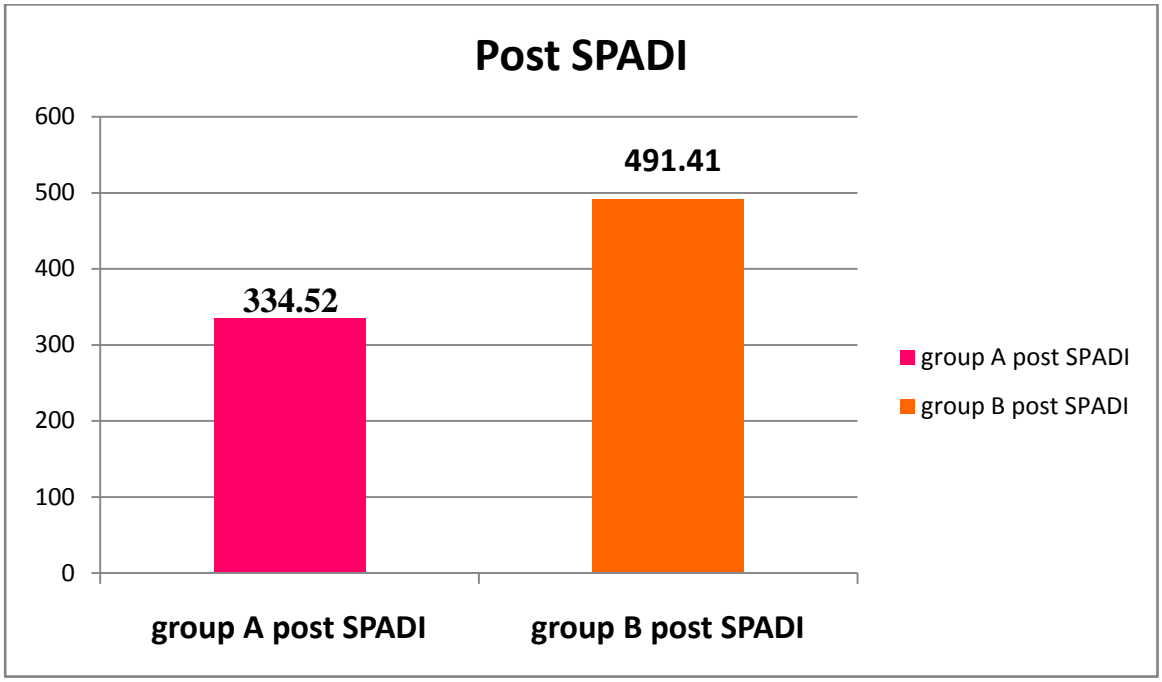
GRAPH- 4.2.5 Mean of pretest values of SPADI of Group A and B

INDEPENDENT 't' test – pretest for SPADI



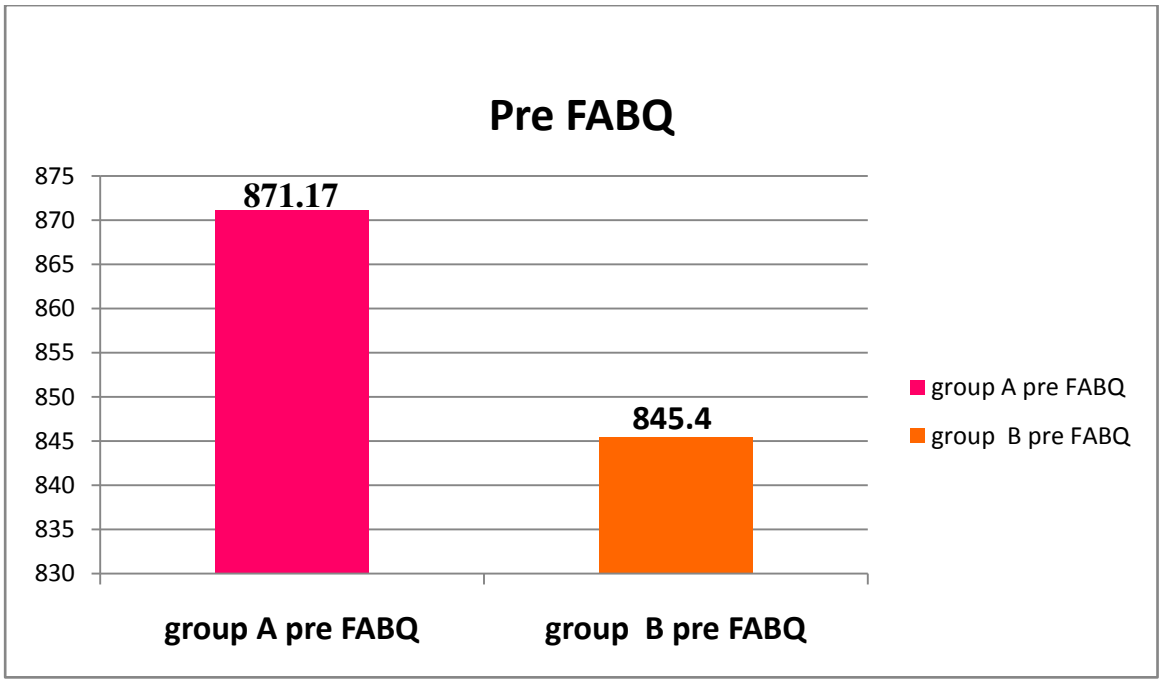
GRAPH-4.2.6 Mean of post test values of SPADI of Group A and B

INDEPENDENT 't' test – post test for SPADI



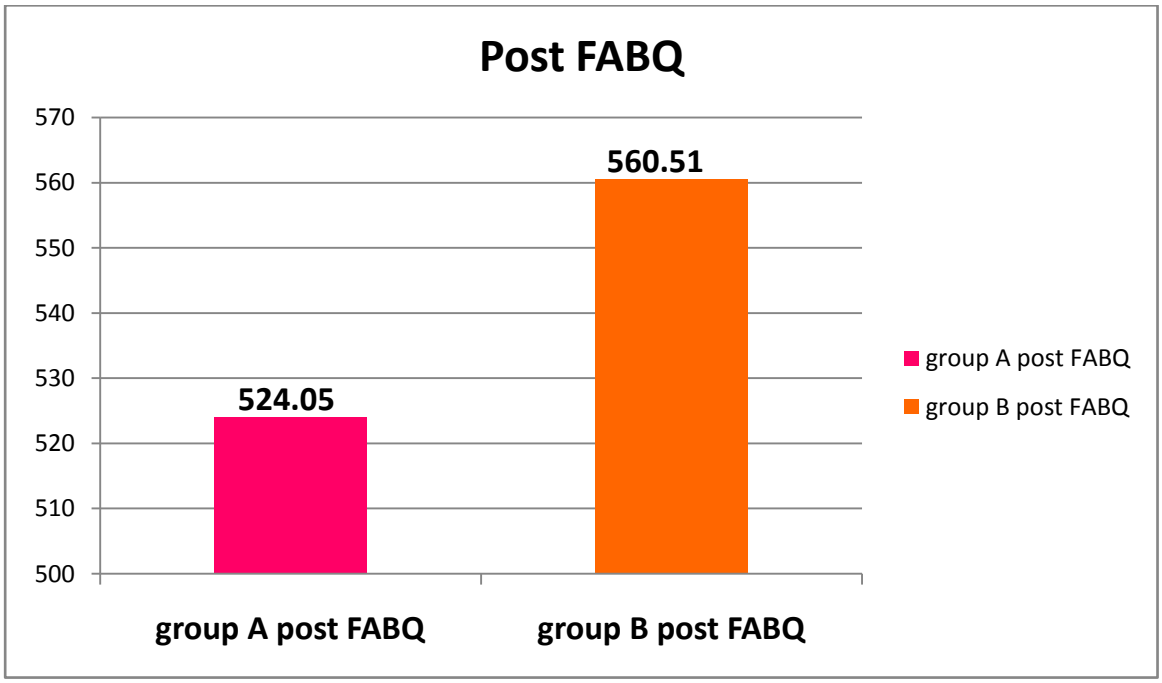
GRAPH- 4.2.7 Mean of pretest values of FABQ of Group A and B

INDEPENDENT 't' test – pretest for FABQ



GRAPH-4.2.8_Mean of post test values of FABQ of Group A and B

INDEPENDENT 't' test – post test for FABQ



5. RESULTS AND DATA ANALYSIS

PAIRED ‘t’ TEST:

(a) SHOULDER PAIN AND DISABILITY INDEX.

Group A [scapular muscle force couple activation exercises]

The pre-test and posttest values of shoulder pain and disability index was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table‘t’ value was 2.145 and the calculated ‘t’ value was 37.67. Since the calculated ‘t’ value was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in shoulder pain and disability index in group A.

Group B [conventional exercises]

The pre-test and posttest values of shoulder pain and disability index was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 14.35. Since the calculated ‘t’ value was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in shoulder pain and disability index in group B.

(b) FEAR AVOIDANCE BELIEF QUESTIONNAIRE.

GroupA[scapular muscle force couple activation exercises]

The pre-test and posttest values of fear avoidance belief questionnaire was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table‘t’ value was 2.145 and the calculated ‘t’ value was 14.47. Since the calculated ‘t’ value was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in fear avoidance belief questionnaire in group A.

Group B [conventional exercises]

The pre-test and posttest values of fear avoidance belief questionnaire was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 10.38. Since the calculated ‘t’ value

was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in fear avoidance belief questionnaire in group B.

INDEPENDENT ‘t’ TEST:

(a) SHOULDER PAIN AND DISABILITY INDEX.

Pre test values:

The pre-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 1.25. Since the calculated ‘t’ value was less than the table‘t’ value null hypothesis was accepted. Hence, there was no significant improvement in shoulder pain and disability index in both group A and B.

Post test values:

The post-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 11.17. Since the calculated ‘t’ value was greater than the table‘t’ value null hypothesis was rejected. Hence, there was significant improvement in shoulder pain and disability index in both group A and B.

(b) FEAR AVOIDANCE BELIEF QUESTIONNAIRE.

Pre test values:

The pre-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 0.68. Since the calculated ‘t’ value was less than the table‘t’ value null hypothesis was accepted. Hence, there was no significant improvement in fear avoidance belief questionnaire in both group A and B.

Post test values:

The post-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 1.61. Since the calculated ‘t’ value was lesser than the

table‘t’ value null hypothesis was accepted. Hence, there was no significant improvement in fear avoidance belief questionnaire in both group A and B.

6. DISCUSSION

Subacromial shoulder impingement syndrome is common in adult populations due to the functional narrowing of the subacromial space. Almost all the patients who exhibits with the shoulder pathology will be associated with the dysrhythmic movement that results in the abnormal scapulohumeral rhythm. Similarly, in the subacromial impingement also, scapular muscle weakness was found. It is not certain whether the poor scapular muscles strength, alters the scapula humeral rhythm and causes excessive tension in the supra spinatus muscle that results in micro trauma and inflammation, or the repetitive over head motions that causes the reduction in the normal space in the coraco acromial arch which affects the normal synchronised movement of the scapula over the thorax.

The purpose of this study was to evaluate the effects of emphasizing scapular muscle force couple activation and conventional exercises in treating scapular dyskinesis in patients with secondary subacromial impingement syndrome. The study mainly focuses on the pain disability, level of fear in the impingement population, where both the experimental and control groups were improved in pain, disability and level of fear but the experimental group showed better results comparatively.

PAIN:

There is a significant improvement in pain in both the experimental and control groups that could be as per the neurophysiologic pain reduction phenomenon which is associated with graded movement. It has been reported that while stimulating the type I and II afferent articular mechanoceptors, reflexogenically reduces the tone and awareness of pain. In contrast the experimental group received additional exercises that mainly concerned with the synchronized motor firing of the serratus anterior, lower trapezius and upper trapezius that plays major role in eliciting normal scapula-humeral rhythm. The repeated movements done by the shoulder joint, along with the continuous stimulation of these muscles, not only results in the regaining of normal range, but also pain reduction due to the reduction in the level of fear and increased confidence levels. The functional exercises that activates the force-couple of scapula and humerus, ultimately resulted in better prognosis in pain reduction.

DISABILITY:

Eventually, both the control and experimental group shows a significant improvement in the disability, the experimental group is beneficial with the effects of added exercises. The scaption plane elevation exercises, D2 flexion pattern exercises improves the over head motions with out pain, where the greater tuberosity is pulled away from the glenoid fossa, at the end range of the over head movements, especially in the scaption plane elevation.

Additionally, the coupling effect is well achieved in the prone lying rowing that continued with the scapular retraction along with the glenohumeral abduction and end range extension. Eerxises thar are done with the closed kinetic chain such as the Lawnmover exercises, robbery exercises provides bilateral effects stimulating the serratus anterior, lower trapezius along with the trunk movements. Squatting during these exercises provides no obvious effect in treating

the scapular dyskinesis in these patients. The disability prognosis found better in experimental group due to the increased and repeated training to the core pathology area that produced compensary action in the shoulder joint.

FEAR:

Recent evidences suggests that a combination of psychological cognitive, environmental and neurophysiological factors in the etiology and maintenance of chronic pain. It has been suggested that fear of pain, and activity driven by the anticipation of pain and increased injury rather than the noxious sensory stimuli associated with pain itself, produces strong negative reinforcement for the persistence of avoidance behavious (Dennis C. Et al). Assessing the level of fear, enables to judge the prognosis of the individual patient. Repeated movements in a particular direction enables the patient to be aware of the movement that should be done and assess the pain that might produce during the movement. The experimental group was targeted with the exercises that focuses on the scapulothoracic and scapulohumeral muscles. As these muscles such as the serratus anterior, lower trapezius, rhoimboids and upper trapezius are stimulated , they are pulled in the normal anatomical pathway that in turn, reduces the pain, incorporates proper range without impinging or damaging the other adjacent structures. To assess the level of fear that associated with the condition, the fear avoidance belief scale is used and found that there is a significant improvement in both the control and experimental groups but no major difference between these 2 groups was obvious.

7. CONCLUSION

The study aimed at finding the effects of emphasizing the scapular muscle force couple activation and conventional exercises to treat scapular dyskinesis in patients with secondary subacromial impingement syndrome, where 30 subjects were recruited in this study and divided into two groups, 15 subjects in Group (A)-force couple activation exercises, and 15 subjects in Group (B)- conventional exercises. Scapular muscle force couple activation exercises were given along with the conventional exercises where as the control group received only conventional exercises.

Pain, disability and level of fear were assessed initially and at the end of the 4th week using the Shoulder Pain and Disability Index (SPADI), and Fear Avoidance Belief Questionnaire (FABQ). The results were analysed statistically by using the independent 't' test and paired 't' test at the 5% level of significance. The experimental group showed significant improvement in the pain and disability but no much differences in the level of fear.

Thus, the result of this study indicates that exercises thar are focuses on treating the scapular dyskinesis along with conventional exercises that targets the glehohumeral motion and muscular strength, in the secondary subacromial impingement syndrome are more effective and statistically signifies in improvement.

8. LIMITATIONS AND SUGGESTIONS

8.1 LIMITATIONS

- The population of the study was too small
- study duration was very less
- criteria for inclusion in this study doesnot use confirmatory test like subacromial steroid injection/ other imaging modalities to rule out the exact structure involved, hence accurate diagnosis remains questionable.
- age group difference was too large in the inclusion criteria
- visual diagnosis of scapular dyskinesis may vary from therapist to therapist

8.2 SUGGESTIONS

- Further studies can be conducted with a large sample size
- longitudinal study and follow-up can be done to see the sustence of effects
- supervised therapy sessions can be organised rather than providing home exercises program to gain constant motivation of the patients
- 3-dimentional movement analysis can be done to find the accuracy of the abnormality in the scapulohumeral rhythm.

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INFORMED CONSENT FORM

I ---------- voluntarily consent to participate in the research study, "EMPHASIZING SCAPULAR MUSCLES FORCE COUPLE ACTIVATION AND CONVENTIONAL EXERCISES TO TREAT SCAPULAR DYSKINESIS IN PATIENTS WITH SECONDARY SUBACROMIAL IMPINGEMENT SYNDROME"

The researcher has explained me the treatment approach in brief, the risk of participation and has answered the question related to the research to my satisfaction.

Signature of participant Signature of the researcher

Signature of the witness

Place:

Date:

ASSESSMENT FORM

Name: Date:

Age: Time:

Gender:

Occupation:

Reffered by:

Chief complaints:

Present medical history:

Past medical history:

Pain history:
Side:
Site:
Onset:
Duration:
Frequency:
Type:
Aggravating factors:
Relieving factors:

ON OBSERVATION:

Body built:
Posture:
Pattern of movement:
Contour of shoulder:
deformity:
Usage of assistive devices:
Tropical changes:

ON PALPATION:

Swelling:
Tenderness:
Warmth:
Tissue texture:
Crepitus:

ON EXAMINATION:

Range of motion

ACTION	RIGHT	LEFT
Flexion		
Extension		
Abduction		
Adduction		
Internal rotation		
External rotation		

MUSCLE POWER:

SHOULDER MUSCLES	RIGHT	LEFT
Flexors		
Extensors		
Abductors		
Adductors		
Internal rotators		
External rotators		

SCAPULAR MUSCLES	RIGHT	LEFT
Elevators		
Depressors		
Protractors		
Retractors		
Upward rotators		
Downward rotators		

Sensation:
Endfeel:
Joint play:
Reflexes:
Gait pattern:

POSTURE ASSESSMENT:

Anterior view:
shoulder blades:

Posterior view:
superior angle of scapulae:
spine of scapulae:
Inferior angle of scapulae:
Medial border prominence:

SPECIAL TESTS:

1. Neer's impingement test:
2. Hawkins kennedy test:
3. Empty can test:
4. Painful arc sign:
5. Scapular assistance test:
6. Scapula reposition test:

CONFIRMATORY DIAGNOSIS:

SHORT TERM GOALS:

LONG TERM GOALS:

ERGONOMIC ADVICES:

Shoulder Pain and Disability Index

Please place a mark on the line that best represents your experience during the last week attributable to your shoulder problem.

Pain scale

How severe is your pain?

Circle the number that best describes your pain where: **0** = no pain and **10** = the worst pain imaginable.

At its worst?	0	1	2	3	4	5	6	7	8	9	10
When lying on the involved side?	0	1	2	3	4	5	6	7	8	9	10
Reaching for something on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Touching the back of your neck?	0	1	2	3	4	5	6	7	8	9	10
Pushing with the involved arm?	0	1	2	3	4	5	6	7	8	9	10

Total pain score _____ /50 x 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, eg. if 1 question missed divide by 40)

Disability scale

How much difficulty do you have?

Circle the number that best describes your experience where: **0** = no difficulty and **10** = so difficult it requires help

Washing your hair?	0	1	2	3	4	5	6	7	8	9	10
Washing your back?	0	1	2	3	4	5	6	7	8	9	10
Putting on an undershirt or jumper?	0	1	2	3	4	5	6	7	8	9	10
Putting on a shirt that buttons down the front?	0	1	2	3	4	5	6	7	8	9	10
Putting on your pants?	0	1	2	3	4	5	6	7	8	9	10
Placing an object on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Carrying a heavy object of 10 pounds (4.5 kilograms)	0	1	2	3	4	5	6	7	8	9	10
Removing something from your back pocket?	0	1	2	3	4	5	6	7	8	9	10

Total disability score: _____/ 80 x 100 =_____ %

(Note: If a person does not answer all questions divide by the total possible score, eg. if 1 question missed divide by 70)

Total Spadi score: _____ 130 x 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, eg if 1 question missed divide by 120)

Minimum Detectable Change (90% confidence) = 13 points
(Change less than this may be attributable to measurement error)

Source: Roach et al. (1991). Development of a shoulder pain and disability index.

Name: _____ Date: _____

Here are some of the things which other patients have told us about their pain. For each statement please circle any number from 0 to 6 to say how much physical activities such as bending, lifting, walking or driving affect or would affect your pain.

	COMPLETELY DISAGREE			UNSURE			COMPLETELY AGREE
1. My pain was caused by physical activity	0	1	2	3	4	5	6
2. Physical activity makes my pain worse	0	1	2	3	4	5	6
3. Physical activity might harm my back	0	1	2	3	4	5	6
4. I should not do physical activities which (might) make my pain worse	0	1	2	3	4	5	6
5. I cannot do physical activities which (might) make my pain worse	0	1	2	3	4	5	6

The following statements are about how your normal work affects or would affect your pain.

	COMPLETELY DISAGREE			UNSURE			COMPLETELY AGREE
6. My pain was caused by my work or by an accident at work	0	1	2	3	4	5	6
7. My work aggravated my pain	0	1	2	3	4	5	6
8. I have a claim for compensation for my pain	0	1	2	3	4	5	6
9. My work is too heavy for me	0	1	2	3	4	5	6
10. My work makes or would make my pain worse	0	1	2	3	4	5	6
11. My work might harm my back	0	1	2	3	4	5	6
12. I should not do my normal work with my present pain	0	1	2	3	4	5	6
13. I cannot do my normal work with my present pain	0	1	2	3	4	5	6
14. I cannot do my normal work until my pain is treated	0	1	2	3	4	5	6
15. I do not think that I will be back to my normal work within 3 months	0	1	2	3	4	5	6
16. I do not think that I will ever be able to go back to that work	0	1	2	3	4	5	6

EXERCISE PAMPHLET

1. cervical side bending (for upper trapezius)

- Positon: standing
- Instructions: Side flex the neck to the opposite side. Rotate the head towards the same side.
- கழுத்தை நேராக வைக்கவும், பின்பு வலது புறமாக சாய்த்தபடியே, இடதுபுறமாக திரும்பி பார்க்கவும். அதே நிலையில் 30 நொடிகள் பிடித்து வைத்து, பின் இடது பக்கம் அதே போல செய்யவும்.

2. Scapular protraction (for rhomboids)

- Position: Sitting
- Instructions: Place the hands crossed over the table. Reach for maximum lateral directions
- முதலில் நேராக நிற்கவும். இரு கைகளையும் கோர்த்து பிடித்து தோல் பட்டை அளவுக்கு உயர்த்தவும். பின்பு கைகளை கோர்தவரே முன்னே தள்ள முயற்சிக்கவும். அதே நிலையில் 30 நொடிகள் பிடித்து வைத்து பின் இளைப்பாறவும்.

3. Shoulder horizontal adduction (for posterior capsule)

- Position: standing
- Instructions: bring the arm cross to the body. Use the other hand to apply over pressure, pulling the elbow
- முதலில் நேராக நிற்கவும். வலது கையால் இடது முதுகை தொட முயற்சிதவாறே இடது கையால் வலது கை மேல் அழுத்தம் தரவும். அவ்வாறே 30 நொடிகள் பிடித்து வைக்கவும்.

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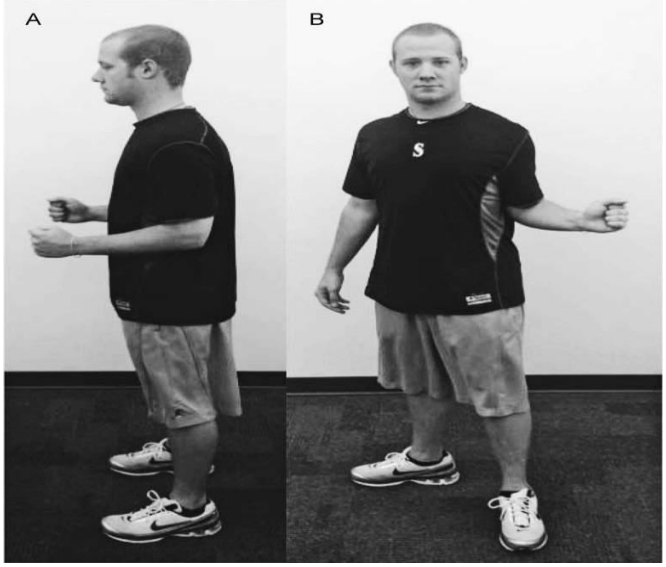
4. Shoulder horizontal abduction (for pectoralis major)

- Position: Stand over a corner of the wall
- Instructions: place the hands over the wall with the chest inbetween the hands and propel the chest forward with feets stable on the ground.
- ஒரு செவுற்றின் மூலையில் இரு கைகளையும் செவிற்றின் மேல் வைத்து நேராக நிற்கவும். பின்பு மெதுவாக உடம்பை முன்னே தள்ளவும். அவ்வாறே 30 நொடிகள் பிடித்து வைத்து, பின் இளைப்பாறவும்.

5. Bow and Arrow exercise

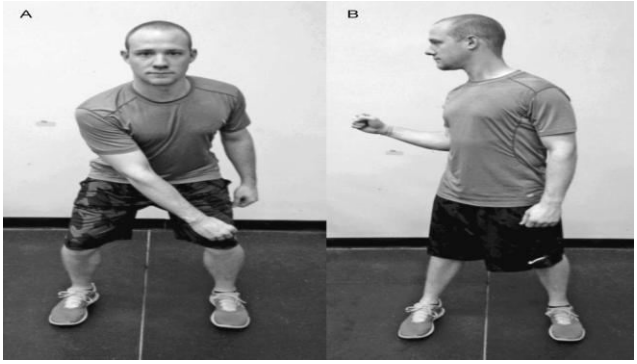
- Position: Standing
- Instruction: Raise the arm upto shoulder level. Pull one of the hand behind and other hand with extended position and vice versa
- முதலில் நேராக நிற்கவும். பின்பு வில் அம்பு விடுவது போல படத்தில் உள்ள படி நிற்கவும். பின்பு அதே போல மற்றொரு கையிலும் செய்யவும்.

6. External rotation with scapular squeeze exercise



- Position: Standing
- Instruction: Flex your elbow with fisting. Move the hand in the outer direction. Do it alternatively in both hands
- முதலில் நேராக நிற்கவும். இரு கைகளையும் படத்தில் உள்ளவாறு மடக்கவும். பின்பு கைகளை உடம்போடு ஒட்டியபடியே மணிக்கட்டை வெளிப்புறமாக கொண்டு செல்லவும்.

7. Lawnmower exercise

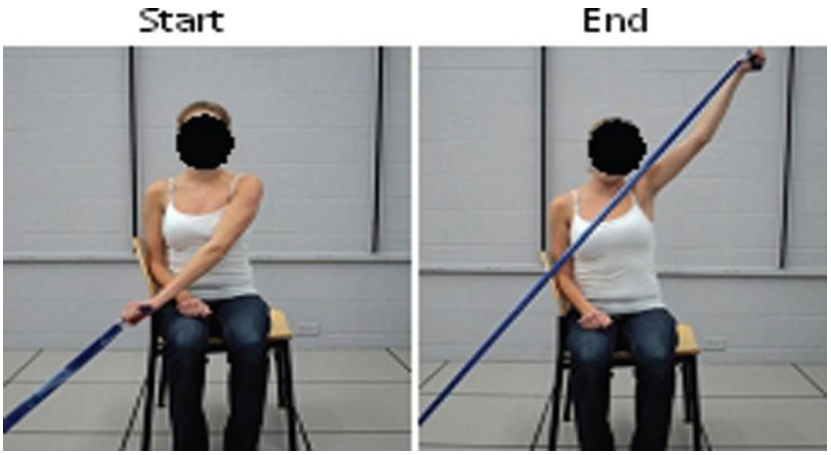


- Position: Standing
- Instruction: Flex your elbow with fisting. Extend it by using the body with bending then trunk forward. Bring back the hand to flexed position by twisting the trunk. Do alternatively in both hands.
- முதலில் நேராக நிற்கவும். வலது கையை மடக்கியவாறே பின் நோக்கி பார்க்கவும். பின்பு முன்னே திரும்பியவாறே வலது கையால் இடது கால் மூட்டை தொடுவது போல கால் முட்டிகளை மடக்கி தொட முயற்சிக்கவும்.

8. Robbery exercise

- Position: Standing
- Instruction: Flex your elbow with shoulders retracted. Extend it infront of your body with bending the trunk forward along with semi squatting. Bring back the hands to flex position with erect standing.
- நேராக நின்றவரே இரு கைகளையும் உடம்போடு ஒட்டி வைத்து மடக்கி பிடிக்கவும். பின்பு கால் முட்டிகளை மடக்கி உட்கார முயற்சிதவாறே இரு கைகளையும் கால் முட்டிக்கு நேராக நீட்டவும்.

9. D2 flexion pattern exercise

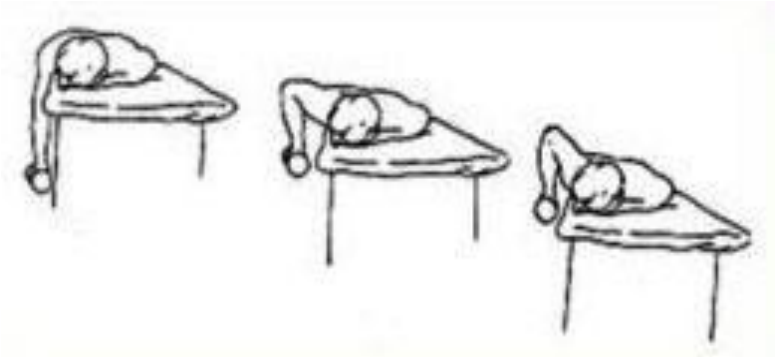


- Position: Standing
- Instruction: Bring the arm to the opposite side lower end. Make a cross movement by taking it to the same side upper end. Do it alternatively
- முதலில் நேராக நிற்கவும். பின்பு வலது கையால் இடது பக்க இடுபளவில் இருந்து மேல் நோக்கி வலது புறமாக ஒரு கோடு போல கையை கொண்டு செல்லவும். அதே போல மற்றொரு கையிலும் செய்யவும்.

10. Scaption plane elevation

- Position: Standing
- Instruction: Flex the arm forward wih palms facing towards the opposite palm. Raise the arm upto the maximum level. Do it alternatively
- முதலில் நேராக நிற்கவும். பின்பு இரு உள்ளங்கைகளை பார்த்தவாறு உள்நோக்கி வைத்தவரே மேலே உயர்த்தவும்.

11.Prone lying rowing

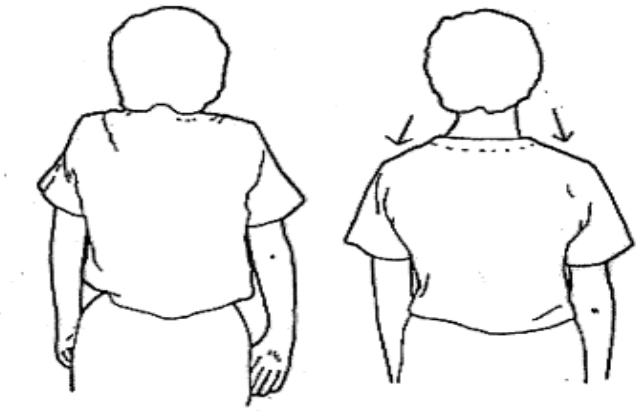


- Position: Prone lying
- Instruction: Lye down at the edge of the couch. Hang down the treatment hand at the edge. Now pull the hand from down to up with shoulders retracted.
- தலை குப்புற மெத்தையின் விளிம்பில் படுக்கவும். வலது கையை கீழே தொங்கிய படி விடவும். பின்பு கையிற்றை இழுப்பதை போல அதே நிலையில் இருந்து செய்யவும்.

12.Codman's pendular exercise

- Position: Stooped standing
- Instruction: Bend down with the arm hanging freely. Make small-large circles with the hand in clock-wise and anti-Clockwise directions.
- படத்தில் உள்ளவாறு ஒரு மேஜையின் மீது கை வைத்து கொண்டு கீழே குனியவும் பின்பு மற்றொரு கையால் சிறிய வட்டங்களை போடவும். பின்பு மாற்று திசையிலும் சுற்றவும்.

13.Shoulder shrugging exercises



- Position: Standing
- Instruction: Leave the arm free and relaxed. Try to pull the shoulder blades to touch the ears and then relax
- முதலில் நேராக நிற்கவும். பின்பு தோல் பட்டையை காதருகே படத்தில் உள்ளவாறு கொண்டு செல்லவும்

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14.Seated dips

- Position: Sitting
- Instructions: Hold the arm rest of the chair. Try to get down from the chair without taking the hands off from it
- ஒரு நாற்காலியில் நேராக அமரவும். கைகளால் நாற்காலியின் கைபிடியை இருக்கபிடித்து எழுந்திரிக்கவும். பின்பு மெதுவாக ஒரு அடி முன்னே சென்று கைபிடியை பிடித்தவாறே படத்தில் உள்ளவாறு கீழே அமர முயற்சித்து பின் எழவும்.

1. INTRODUCTION

Shoulder impingement syndrome is a common musculo skeletal disorder which is a broad term of mentioning the shoulder pain. According to the site and etiology of the pain, anatomical variations, mechanical loading disturbances and muscle imbalance involvement, clinicians subdivided or categorised the shoulder impingement syndrome into subacromial or external impingement; internal impingement that is divided into anterior and posterior and coracoid impingement.

The sub acromial or external impingement syndrome is further divided into primary subacromial impingement syndrome typically seen in older population results from physical narrowing of the subacromial space and commonly caused by rotatorcuff or bursal fibrosis, corocoacromial arch calcification, hooked acromian, bone spur development, distal clavicle or acromio clavicular joint degeneration, whereas more recently the secondary shoulder impingement syndrome is the result of functional narrowing of sub acromial space, common in younger population resulting in scapulo thoracic muscle weakness, posterior capsule tightness, gleno humeral instability hence results in the lack of scapular stability that contributes to the secondary sub acromial impingement syndrome.

The maintenance of normal scapulo humeral rhythm is essential in patients with shoulder impingement syndrome in order to attain complete range of motion despite of pain for performing functional activities and to prevent secondary complications that may lead to contracted shoulder capsule which either worsen the condition and pave path for another shoulder pathologies such as shoulder or adhesive capsulitis or frozen shoulder.

The scapulo humeral rhythm essentially serves for at least two purposes:

1. Presentation of the length – tension relationships of the gleno humeral muscles; the muscles do not shorten as much as they would without the scapular upward rotation and so they can sustain their force production through a larger portion of range of motion.
2. It prevents impingement between the humerus and the acromion.

The scapulo humer rhythm is maintained by the production of the force couple initially in the gleno humeral abduction by the force couple of the rotatorcuff and deltoid; upward rotation of the scapula by the production of the force couple of serratus anterior and trapezius muscles, hence it occurs in the ratio of 2:1 that is 2 degree of gleno humeral motion for every one degree of scapulo thoracic motions. Theoritically patients with the gleno humeral pathologies often exhibit inhibitions or imbalance within the scapular muscles in both static and dynamic activity of the gleno humeral joint that finally results in the scapular dyskinesis.

Scapular dyskinesis is a generalised term that defines the loss of scapular control and motions due to the imbalance or fatigue or weakness or abnormal firing of the motor neurons of the scapulo thoracic muscles. The scapula muscles are divided into two broad categoires viz; the scapulohumeral muscles that comprises of supra spinatus, infra spinatus, teres minor, sub scapularis (SITS) and deltoid and the scapulothorcic muscles that consists of the serratus

anterior and trapezius (the major stabilisers of scapula on thorax) and rhomboids, levator scapulae and pectoralis minor muscles.

Altered muscle balance such as upper trapezius over compensation or hyper activity and variable (timing) or insufficient (reduced amplitude) middle trapezius, lower trapezius, serratus anterior activity occurs in individuals with secondary sub acromial impingement syndrome.

The rehabilitation protocols to treat the secondary subacromial impingement syndrome abundantly dependent on directly targeting the scapulohumeral muscles by the range of motions, stretching and rotatorcuff strengthening exercises. The compensatory or affected normalized pattern of movements that occurred at the scapulothoracic joint is left untreated in individuals with secondary subacromial impingement syndrome. To elicit the complete shoulder abduction, as per the scapulohumeral rhythm theorized the scapula muscle activation is essential to elicit the functional activities despite of pain in individuals with secondary subacromial impingement syndrome.

The force couple activation directly targets the coordinated, synchronized activation of the muscles that compose the scapular upward rotation force couple for stabilization and a well co-ordinated elicitation of the scapulohumeral rhythm. The exercises focus on upward rotation force couple by increasing strength, promoting proper firing between muscles of force couple by directly targeting the activation of lower trapezius, middle trapezius and serratus anterior while simultaneously minimizing the activation of upper trapezius.

1.1 NEED FOR THE STUDY

Shoulder impingement syndrome consists of various rehabilitation protocols that includes the manual therapy, thermotherapy, cryotherapy, hydro therapy, exercise therapy and reported better outcomes with evidences. Improving the functional activities of the patients with secondary subacromial impingement syndrome is challenging with the conventional exercise programs that directly targets the affected structures (rotator cuff tendons) and the outcomes are not sound valid for prolonged benefits since the core etiology is not treated.

Electro myographic studies focuses on activating the upward rotators of the scapula in populations such as overhead throwers, althletes, sportsmen and healthy individuals. Studies that included the patients with shoulder impingement syndrome, provided results that are mixed with the activation of both scapulohumeral and scapulothoracic muscles and so investigating the effects of isoloated scapulothrocic muscles force couple muscle activation mechanism may provide a essential information on strength, applicability and importance of serratus anterior, trapezius muscle in the prognosis of the patients with secondary subacromial impingement syndrome.

The effects of isolated activation of scapular stabilizers had been proven already in both the normal healthy sportsmen and also patients with impingement syndrome and other shoulder pathologies. Force couple activation of the scapular retractors and upward rotators when together done it might produce better outcome since it acts in the anatomical movement pattern. Hence emphasizing the force couple activation is patients with scapular dyskinesis in secondary subacromial impingement syndrome might produce amazing outcomes when comparing with the conventional protocols that are targeted on the improving range of motion and muscle power whereas, the experiment induces the simultaneous recruitment of both essential muscles that are weak.

1.2 AIMS AND OBJECTIVES

1.2.1 AIM OF THE STUDY

The aim of the study is to identify the effects of emphasizing the scapular muscles force couple activation and conventional exercises to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.

1.2.2 OBJECTIVES OF THE STUDY

- To study the effects of emphasizing force couple activation of scapular muscles to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
- To study the effects of conventional exercises to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain disability and fear avoidance beliefs.
- To compare the effectiveness of emphasizing scapular muscles force couple activation and conventional exercise to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
- To identify and conclude the best approach in treating the scapular dyskinesis in patients with secondary subacromial impingement syndrome on reducing pain, disability index, fear avoidance beliefs and implement in the current clinical practice.

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2. REVIEW OF LITERATURE

2.1 Shoulder impingement syndrome

Louis U Biglani William et al in 2010 reviewed the current concepts in subacromial impingement syndrome the review classified the etiological factors of subacromial impingement syndrome as intrinsic and extrinsic factor. It briefly explained the various stages of impingement evaluation and diagnosis with conservative and various surgical approaches of the shoulder impingement syndrome

Wing Kchang MD et al in 2004 explained the functional anatomy, sports-specific biomechanics, causes, physical examination, differential diagnosis, rehabilitation and prognosis of the impingement syndrome. The study concluded that impingement syndrome can e treated either conservatively/surgically. Accurate diagnosis and adequate treatment based on history, physical examination and appropriate diagnostic testing yields good prognosis.

2.2 Association between shoulder impingement syndrome and scapular dykinesis

Clinical implications of scapular dyskinesis in shoulder injury: the 2013 consensus statement for scapular summit

W Ben Kibler Et All, conducted a consensus conference on the scapula to discuss the accumulated knowledge regarding the scapular involvement in various shoulder injuries and the major conclusions of the conference were 1. Shoulder impingement symptoms are particularly affected by the scapular dyskinesis. 2. Rehabilitaiton programmes to restore scapular position and motion can be effective for better prognosis of shoulder impingement syndrome.

Shoulder Impingement : Biomechanical considerations in rehabilitation
Paula M Ludewig Et All published a manuscript that discusses the biomechanical aspects of shoulder joint and shoulder impingement syndrome relationship. They also presented 2 case examples and discussed the application of coupled interactions and potential mechanisms of movement abnormalities in targeting treatment intervention for movement based subgroups of impingement patients.

2.3 Effects of conventional exercises in shoulder impingement syndrome

Jeffry A Fleming et al in 2010 compared the interventions like manual therapy, exercises with other treatment for the rehabilitation of shoulder impingement syndrome. The study reviewed level I and II randomized controlled trial to form the components of the physical therapy programs used in each study. Findings from these reviews indicate that exercise is effective for pain reduction and improving function in subjects with impingement syndrome.

John H Kuhn et al in 2008 developed evidence based protocol and evaluated the effects of therapeutic exercises for shoulder impingement syndrome. 11 RCT studies are analysed for clinical and statistical significance of exercise program of in shoulder impingement. This systemic review suggests strong recommendation for exercises in reduction of pain, improvement in function but not in range of motion. Data reviewed in this study can be used in the design of standard exercise protocol for shoulder impingement syndrome.

Philip W Mcclure et al in 2004 conducted a study to examine the exercise program in patients with shoulder impingement syndrome. The purpose of their study was to identify the changes that might occur in 3-dimentional scapular kinematics, physical impairements and functional limitations. 59 patients with shoulder impingement syndrome were recruited and 39 patients successfully completed the 6 week rehabilitation program and follow-up testing. The study concluded that use of exercise protocol in the management of shoulder impingement syndrome have positive impact on patients impairments and functional limitations.

2.4 Effects of treating scapular dyskinesis

Baskurt Z et al in 2011 conducted a study to investigate the effectiveness of stretching, strengthening exercises and the scapular stabilization exercises on the pain, shoulder range of motion, muscle strength, joint position sense, scapular dyskinesis in patients with impingement syndrome. Lateral scapular slide test, western Ontario rotator cuff index were evaluated before and after treating and result suggested that for the treatment of impingement syndrome, scapular stabilization exercises given with stability and stretching exercises can be more effective in increasing the muscle strength and decreasing the scapular dyskinesis.

Effects of scapular function training and chronic pain in the neck or shoulder region: Randomized controlled trial, **Christoffer H. Anderson** (2013) Et All conducted a study to investigate intensive scapular function training in terms of training lower trapezius and serratus anterior muscles while minimising direct training of the upper trapezius was found effective in decreasing pain in neck or shoulder region and pressure pain threshold in lower trapezius where the scapular functional training was compared with control group. The

Scapular function training reduced pain intensity and increases shoulder elevation strength in adults with chronic non-specific pain in neck or shoulder region

Laura Schmitt MSPT et al in 1999, came out with a case report in which he found that the scapular winging began at the onset of shoulder elevation and also a frank serratus anterior weakness represents the scapulo thoracic instability. It suggest that appropriate timing and function of the force couple between serratus anterior and trapezius need to occur to avoid impingement of rotator cuffs and bursa in subacromial space it was concluded with that treatment should be given to weak muscles and not substitute with strong muscles resulted in a rapid return of the function

F.Struyf et al in 2012 conducted a study in which the impingement syndrome was treated with the scapula focused treatment and compared with the conventional therapy. The scapular focused treatment includes exercises of stretching, scapular motor control training. A large clinically important treatment effect in favour of scapular motor control training was found in a self-reported disability and effect were maintained at 3 months follow-up.

2.5 Effects of functional rehabilitation exercises targeting the force couple activation

Scapular muscles activation ratios in patients with shoulder inuries during functional shoulder exercises

Chad R Moeller MS (2014) Et All conducted a study to determine scapular muscle activation ratio and individual muscle ratio activity of UT, SA, LT and MT with GH injury and health control participants. They found high activation ratios during the external rotation with scapular squeeze exercises in serratus anterior and bow and arrow exercises in MT and LT/

Electromyographic activity of scapular muscles during diagonal patterns using elastic resistance and free weights.

Dexter Witt PT, DPT (2011) Et All conducted a EMG study to identify the muscle recruitment in various diagonal PNF patterns of upper limb such as D1 flexion, D2 flexion, D1 Extension, D2 extension with a elatic resistance and free weights. Studies shows a significant increase in MT, LT recruitement in D2 flexion patterns were SA was significantly remaining same in all patterns.

2.6 Special tests for shoulder impingement syndrome

Robert H.Hawins in 2001 for clinical assessment of the shoulder uses the following test to determine shoulder impingement syndrome. Forced forward elevation, or the neer sign and then forced internal rotation test or Hawkins sign and the third test was the painful arc sign or was an active abduction motion against light resistance. The patient with shoulder impingement syndrome reproduced pain in one or more above tests.

Hegedus EJ in 2006 done a study on the diagnostic accuracy of individual orthopaedic physical examination and revealed that the pooled sensitivity and specificity for the neer test was 79% and 53%, respectively, and for the Hawkins-Kennedy test was 79% and 59% respectively.

Michener LA in 2008 conducted a prospective, blinded study; the main objective of the study was to investigate the reliability and diagnostic accuracy of individual tests and combination of tests for subacromial impingement syndrome (SAIS). 55 participants were included in the study. Patients were evaluated with 5 physical examination tests for SAIS: Neer, Hawkins-kennedy, painful arc, jobe empty can and external rotation tests. Surgical diagnosis was the reference standard. From this study they found out that out of neer impingement test, Hawkins-kennedy test, painful arc test, empty can test, external rotation resistance test, cut point of 3 or more positive of 5 tests can confirm the diagnosis of SAIS, while less than 3 positive of 5 rules out SAIS.

2.7 Identifying scapular dyskinesis

Philip McClure et al in 2009, conducted a study to find a clinical method for identifying scapular dyskinesis on 142 atheletes who used over head arm motions. Videotaping was done from posterior aspect in bilateral weighted shoulder flexion and frontal plane abduction. Scapular dyskinesis was detected y a self-instructioanl format with standardized definitions and video taped example of normal and abnormal motion. The study concluded with the scapular dyskinesis that was defined as the presence of either winging or dysrhythmia with reliability that was calculated with weighted kappa coefficient.

Kibler et al in 2002, conducted a reliability study for testing the intra rater and inter rater reliability of clinical evaluation system for scapular dysfunction. Blinded evaluators were familiarized with the evaluation method of scapular movement pattern before viewing a videotape of 26 subjects with and without scapular dyskinesis. Reliability was assessed by a kappa coefficient. Inter rater reliability was found slightly lower than the intra rater reliability. The results indicate that, the qualitative evaluation method allowed clinicians to standardize the categorization of dynamic scapular dysfunction pattern.

Michener et al in 2006, conducted a study to compare 3-dimentional scapular kinematics, shoulder range of motion, muscle force and posture in 45 subjects with and without impingement syndrome. The range was assessed goniometrically and force by dynamometer and shoulder kinematics was analysed by the electromagnetic motion analysis system. The impingement group demonstrated less range and force in all directions when compared with the control group. The study concluded that the kinematic difference found may represent scapulothoracic compensatory stratergies for the gleno humeral muscle weakness.

2.8 Scapular reposition test

Effects of scapular reposition test on shoulder impingement symptoms and elevation strength in overhead athletes.

Angela. R. Tate PT, Phd (2008) Et All conducted a 2-group, repeated measure study to determine whether manually repositioning the scapula using SRT reduce pain and increase shoulder elevation strength in athletes with and without SI symptoms. 142 athletes were tested with manual repositioning of scapula in retraction, shoulder elevation was measured with mounted dynamo meter and the conclusion was the SRT is a simple clinical test that may be useful in an impairment based classification approach to SIS.

2.9 Shoulder pain and disability index (SPADI) and Fear Avoidance Belief Questionnaire (FABQ)

Thilo O Kromer et al in 2010, conducted a randomized controlled study to found the effectiveness of individualized physiotherapy on pain and functioning compared to a standard exercise protocol in patients presented with clinical signs of subacromial impingement syndrome, where they used SPADI for evaluating the pain and disability and FABQ to evaluate the level of fear in these patients before and after the treatment.

MacDermid J et al in 2006, conducted a study on the shoulder pain and disability index demonstrates factor, construct and longitudinal validity in which it showed valid and high responsivity in assessing the pain and disability.

Waddell et al in 1993, conducted a study on a fear-avoidance beliefs questionnaire FABQ) and the role of fear-avoidance beliefs in pain and disability and the findings are incorporated into a biopsychosocial model of the cognitive, affective and behavioural influences in pain and disability.

Cloke DJ et al in 2005, conducted a comparitive study between functional and patient-based scores in subacromial impingement in which they used the SPADI questionnaire as the main outcome measure and hence it is highly recommended for the use in patients with shoulder impingement syndrome.

Williams JW et al in 1995 conducted a study, 'measuring shoulder function with the shoulder pain adn disability index in which they concluded as a minimum improvement in the total SPADI score of 11 points will e considered as a minimum clinically important change.

Starkle R et al in 2007, conducted a study to investigate the psychomeytric properties and predictive power in a sample of swiss-german low back pain patients. The cross cultural german adaptation of the Fear Aoidance Belief Questionnaire was very successful and yielded psychometric properties and predictive powers of the scale. They concluded as the inclusion of the FAB as predictor variable in studies is highly recommended as they appear to have unique predictive power in analysis of the disability and work loss.

Pfinsten M et al in 2000, conducted a study to analyse the validation of the german version of the FABQ on 302 low back pain patients and they concluded that the scale has been proven to identify patients with maladaptations beliefs which had to be focused on in proper treatment.

3. METHODOLOGY

3.1 Research Design:

Pretest-Post test study design

3.2 Sampling Technique:

Purposive sampling technique

3.3 Study Population:

Outpatients of Orthopedic department of KMCH, Coimbatore.

3.4 Sample Size:

30 samples with 15 in each group
Group A (force couple activation ex's -Experimental): 15
Group B (conventional ex's- Control): 15

3.5 Study Setting:

Physical Therapy Department, KMCH, Coimbatore.

3.6 Study Duration:

4Weeks

3.7 Study criteria

- 3.7.1 Inclusion criteria:

1. Age : 30 to 70 years
2. Gender : both males and females
3. If patients have 2 out of following 5 criteria such as
   - ✓ Positive neer sign
   - ✓ Positive hawking sign
   - ✓ Positive jobe sign
   - ✓ Positive relocation test
   - ✓ Pain with apprehension
4. Positive Scapular Assistance Test (SAT) /Scapular Reposition Test (SRT)
5. Type-1 dyskinesis of scapula
6. Visual analog scale on pain should be less than 7 out of 10 at rest.
7. Range of motion should be greater than 130 degree of abduction which is necessary for muscle testing.
8. Dominant hand

- 3.7.2 Exclusion Criteria:

1. Previous or existing history of:
   Shoulder subluxation, dislocation, Complete rotator cuff tears
2. History of systemic or neurological diseases
3. Cervical radiculopathy
4. spinal deformities, fractures
5. positive speed's or yergason test
6. Generalized myalgia
7. Existing malignancy
8. Upper limb DVT
9. Recent Steroid and/or anti analgesic injections
10. Patient undergoing other physiotherapy treatment or chiro practic treatment for shoulder, neck, upper back in last two months
11. Cardio vascular diseases (Hyper tension, severe MI)

3.8 HYPOTHESIS

- Null Hypothesis:
  - H_{01}- There is no significant effects of emphasizing scapular muscles force couple activation to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
  - H_{02}- There is no significant effects of conventional exercises in treating scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain disability index and fear avoidance beliefs.
  - H_{03}- There is no significant difference between emphasizing scapular muscle force couple activation and conventional exercises in treating the scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.

- Alternate Hypothesis:
  - H_{A1}- There is a significant effects of emphasizing scapular muscles force couple activation to treat scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
  - H_{A2}- There is a significant effects of conventional exercises in treating scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.
  - H_{A3}- There is a significant difference between emphasizing scapular muscle force couple activation and conventional exercises in treating the scapular dyskinesis in secondary subacromial impingement syndrome on reducing pain, disability index and fear avoidance beliefs.

3.9 OUTCOME MEASURES

1. Shoulder Pain and Disability Index (SPADI)
2. Fear avoidance belief questionnaire (FABQ)

3.10 MATERIALS USED:

(a) Plinth
(b) Exercise Pamphlet
(c) Goniometer
(d) Inch tape

3.11 PROCEDURE

In this study 30 patients diagnosed with shoulder impingement syndrome were divided into the experimental group (A) and the control group (B) Pain, disability, level of fear were assessed using the shoulder pain and disability index (SPADI) and the fear avoidance belief questionnaire (FABQ). Force couple activation exercises along with conventional exercises were given to the experimental group (A), where as control group (B) received only the convention exercises for 4 weeks. At the beginning of the study both the groups received the postural education and activity modification instructions. After 4 weeks the subjects were re-assessed using the SPADI and FABQ. Prior to the participation all the subjects were informed about the nature of the study and signed a consent form.

3.11.1 TREATMENT PROTOCOL

EXPERIMENTAL GROUP-A (force couple exercises)

a) Flexibility facilitation exercises:

1. cervical side bending (for upper trapezius)

Positon: standing
Instructions: side flex the neck to the opposite side. Rotate the head towards the same side

2. Scapular protraction (for rhomboids)

Position: sitting
Instructions: place the hands crossed over the table. Reach for maximum lateral directions

3. Shoulder horizontal adduction (for posterior capsule)

Position: standing
Instructions: bring the arm cross to the body. Use the other hand to apply over pressure, pulling the elbow

4. Shoulder horizontal abduction (for pectoralis major)

Position: stand over a corner of the wall
Instructions: place the hands over the wall with the chest inbetween the hands
Propel the chest forward with feets stable on the ground

Each exercises are done with 15 seconds stretch period, 3 secs rest and 3 repetitions bilaterally. 2 sessions/day for 4 weeks.

b) Scapular upward rotator force couple exercises

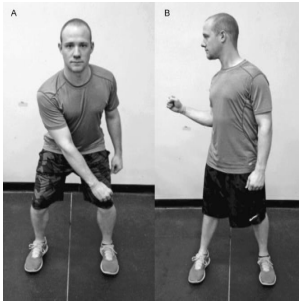
1. Bow and Arrow exercise

Position: Standing
Instruction: Raise the arm upto shoulder level. Pull one of the hand behind and other hand with extended position and vice versa

2. External rotation with scapular squeeze exercise

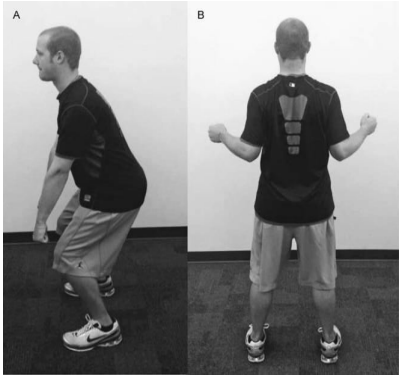
Position: Standing
Instruction: Flex your elbow with fisting. Move the hand in the outer direction. Do it alternatively in both hands.

3. Lawnmower exercise



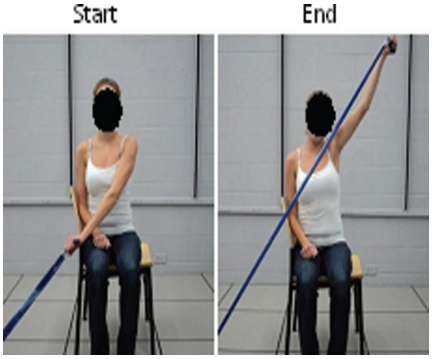
Position: Standing
Instruction: Flex your elbow with fisting. Extend it by using the body with bending then trunk forward. Bring back the hand to flexed position by twisting the trunk. Do alternatively in both hands

4. Robbery exercise



Position: Standing
Instruction: Flex your elbow with shoulders retracted. Extend it infront of your body with bending the trunk forward along with semi squatting. Bring back the hands to flex position with erect standing

5. D2 flexion pattern exercise

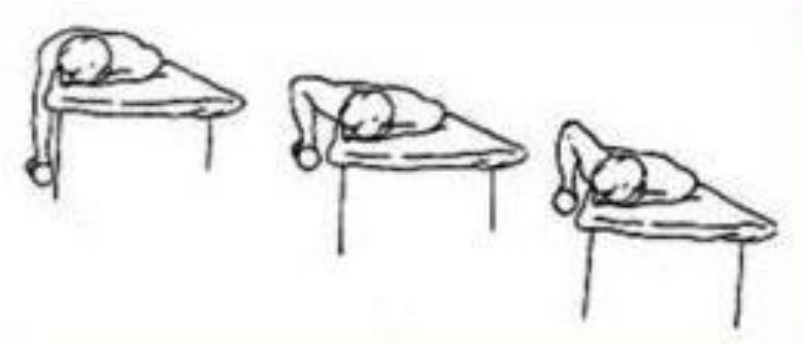


Position: Standing
Instruction: Bring the arm to the opposite side lower end. Make a cross movement by taking it to the same side upper end. Do it alternatively

6. Scaption plane elevation

Position: Standing
Instruction: Flex the arm forward with palms facing towards the opposite palm. Raise the arm upto the maximum level. Do it alternatively.

7. **Prone lying rowing**



Position: Prone lying
Instruction: Lye down at the edge of the couch. Hangdown the treatment hand at the edge. Now pull the hand from down to up with shoulders retracted.

Each exercise is performed with voluntary contraction by the patient despite of pain. 10 repetitions for each exercises that are simultaneously in bilateral limbs with 3 secs rest period in between each exercises

CONTROL GROUP-B (conventional exercises)

a) Flexibility facilitation exercises

1. Cervical side bending (for upper trapezius)
2. Scapular protraction (for rhomboids)
3. Shoulder horizontal adduction (for posterior capsule)
4. Shoulder horizontal abduction (for pectoralis major)

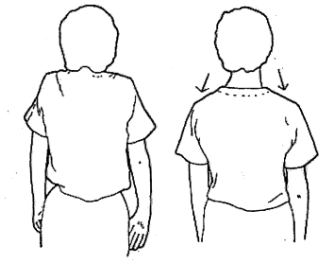
Each exercises are done with 15 seconds stretch period, 3 secs rest and 3 repetitions bilaterally. 2 sessions/day for 4 weeks.

b) Range of motion exercises

1. **Codman's pendular exercise**

Position: Stooped standing
Instruction: Bend down with the arm hanging freely. Make small-large circles with the hand in clock-wise and anti-clockwise directions.

2. Shoulder shrugging exercises



Position: Standing
Instruction: Leave the arm free and relaxed. Try to pull the shoulder blades to touch the ears and then relax.

3. Active shoulder joint movements

Position: Standing
Instruction: Raise your arm in the forward, sideward and backward directions respectively until full range. Twist the arm in and out such that pouring water in a glass

4. Seated dips

Position: Sitting
Instructions: Hold the arm rest of the chair. Try to get down from the chair without taking the hands off from it

3.11.2 TREATMENT DURATION

- The intervention duration was 4 weeks in which the patient performed the exercises actively.
- FREQUENCY: Once a day within 30-40 minutes.
- REST INTERVAL: The patients were asked to perform deep breathing twice during the carryover from one exercise to another and also during the exercises, to avoid the breath holding.
- SPEED: The patients did the exercises at a self selected, comfortable pace.

3.12 PHOTOGRAPHIC REPRESENTATION

3.12.1 Rhoimboids stretching

3.12.2 Posterior capsule stretching

3.12.3 Pectoralis major stretching

3.12.4 Prone lying rowing

3.12.5 Scaption plane elevation

3.12.6 External squeeze exercise

3.12.7 Robbery exercise

3.12.8 Landmover exercise

3.12. 9 Bow and Arrow exercise

3.12.10 Codman's Pendular exercises

3.12.11 Seated dips

3.12.12 Biceps Curls exercise

3.31 STATISTICAL ANALYSIS

DATA ANALYSIS:

1) PAIRED 't' TEST:

$$S = \sqrt{\frac{\Sigma d^2 - (\bar{d})^2 \text{ x } n}{n-1}}$$

$$t = \frac{\bar{d} \text{ x } \sqrt{n}}{S}$$

n = Number of sample

$\bar{d}$ = Mean of Deviation

$\sum d^2$ = Sum of Squared Deviation

2)INDEPENDENT 't' TEST:

$$S = \sqrt{\frac{\Sigma(x_1 - \bar{x}_1)^2 + \Sigma(x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

$\bar{X}_1$ = Mean of group A

$\bar{X}_2$ = Mean of group B

n_1 = Number of sample in group A

n_2 = Number of sample in group B

Level of significance is 5

4. DATA PRESENTATION

4.1 **TABULAR PRESENTATION**

TABLE-4.1.1.1

PAIRED ‘t’ test - SPADI (A)- Experimental group (force couple activation exercises)

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Pre Test	Post test			
SPADI (A)	638.4	334.52	37.67	2.145	0.05

TABLE-4.1.1.2

PAIRED ‘t’ test - SPADI (B)- Control group (conventional exercises)

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Pre Test	Post test			
SPADI (B)	608.4	491.41	14.35	2.145	0.05

TABLE-4.1.1.3

PAIRED ‘t’ test - FABQ (A)- Experimental group (force couple activation exercises)

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Pre Test	Post test			
FABQ (A)	871.17	524.05	14.47	2.145	0.05

TABLE-4.1.1.4

PAIRED ‘t’ test - FABQ (B)- Control group (conventional exercises)

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Pre Test	Post test			
FABQ (B)	845.4	560.51	10.38	2.145	0.05

TABLE-4.1.1.5

INDEPENDENT ‘t’ test – pretest for SPADI

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Group A	Group B			
Pretest values of SPADI	638.4	608.4	1.25	2.048	0.05

TABLE-4.1.1.6

INDEPENDENT ‘t’ test – post test for SPADI

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Group A	Group B			
Posttest values of SPADI	334.52	491.41	11.17	2.048	0.05

TABLE-4.1.1.7

INDEPENDENT ‘t’ test – pretest for FABQ

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Group A	Group B			
Pretest values of FABQ	871.17	845.4	0.68	2.048	0.05

TABLE-4.1.1.8

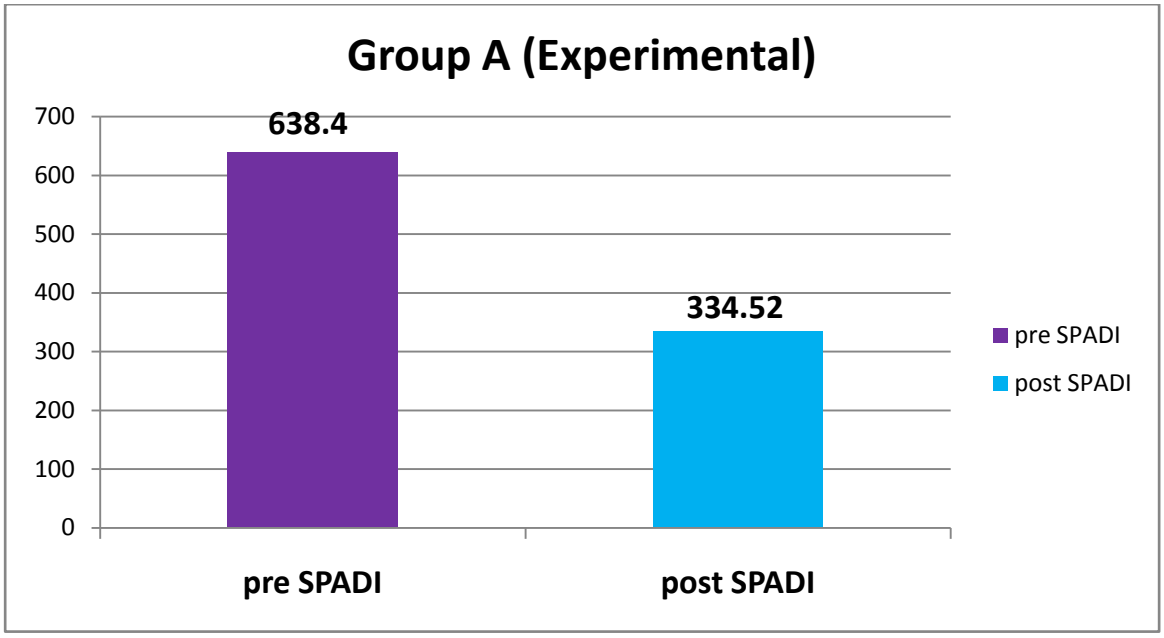
INDEPENDENT ‘t’ test – post test for FABQ

OUTCOME MEASURES	Mean value		Calculated ‘t’ value	Table ‘t’ value	Level of significance
	Group A	Group B			
Posttest values of FABQ	524.05	560.51	1.61	2.048	0.05

4.2 GRAPHICAL PRESENTATION

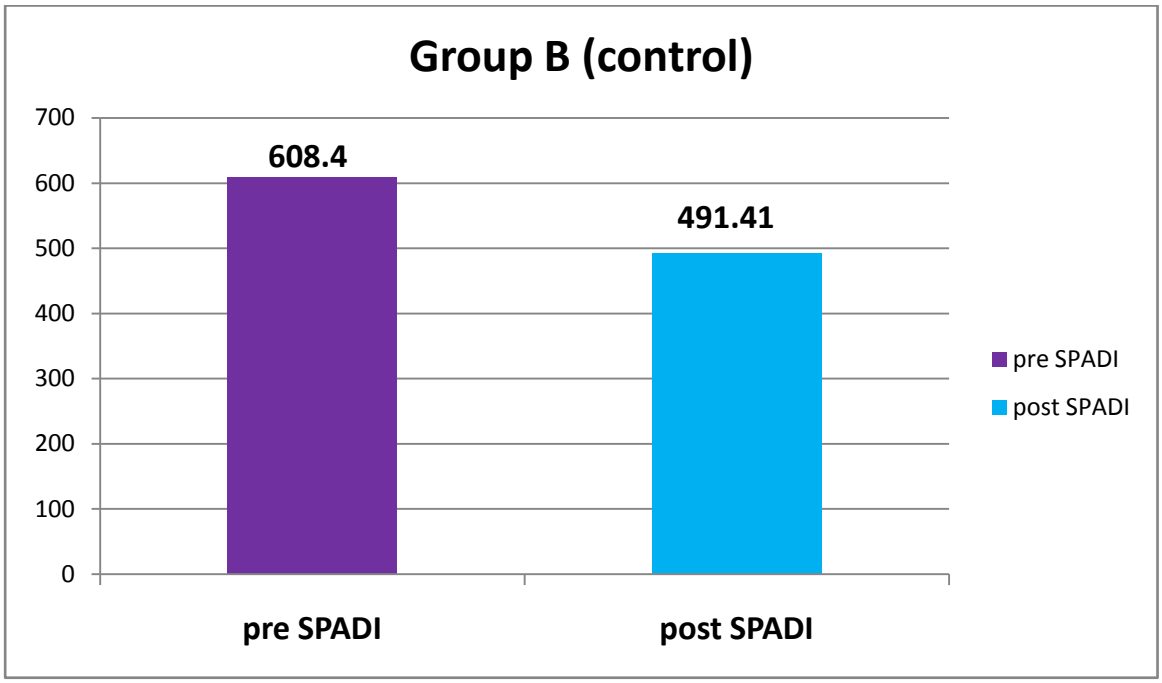
GRAPH- 4.2.1_Mean of pre test and post test values of SAPDI of Group A

PAIRED 't' test - SPADI (A)- Experimental group (force couple activation exercises)



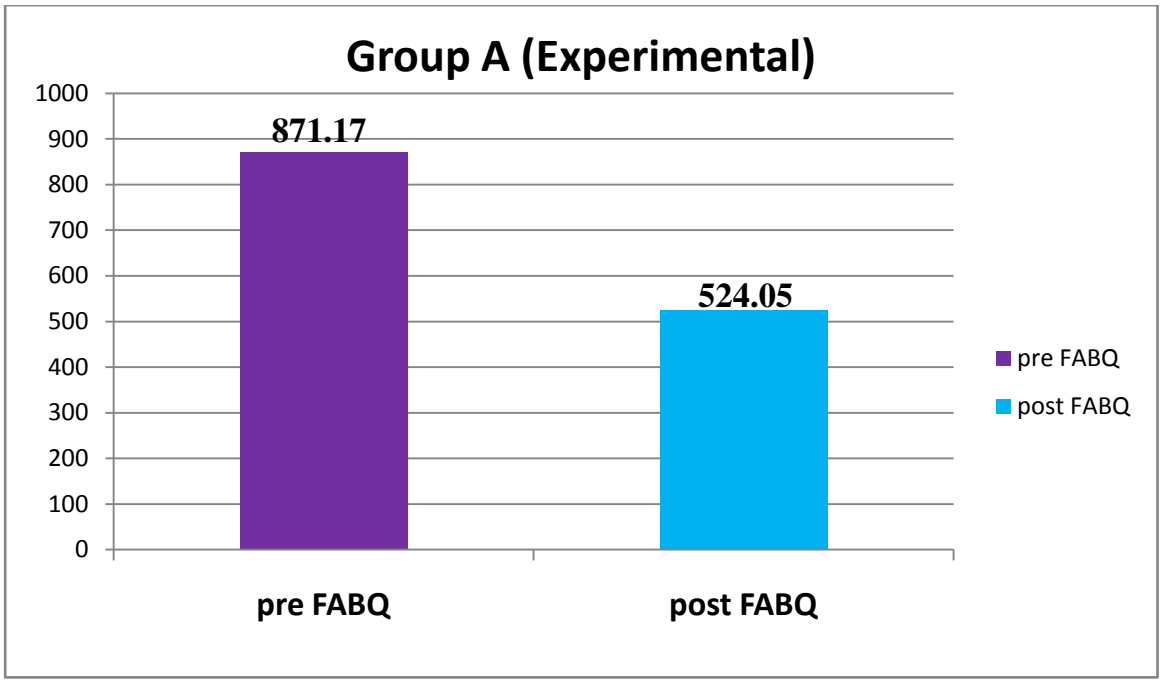
GRAPH- 4.2.2 Mean of pre test and post test values of SAPDI of Group B

PAIRED 't' test - SPADI (B)- Control group (conventional exercises)



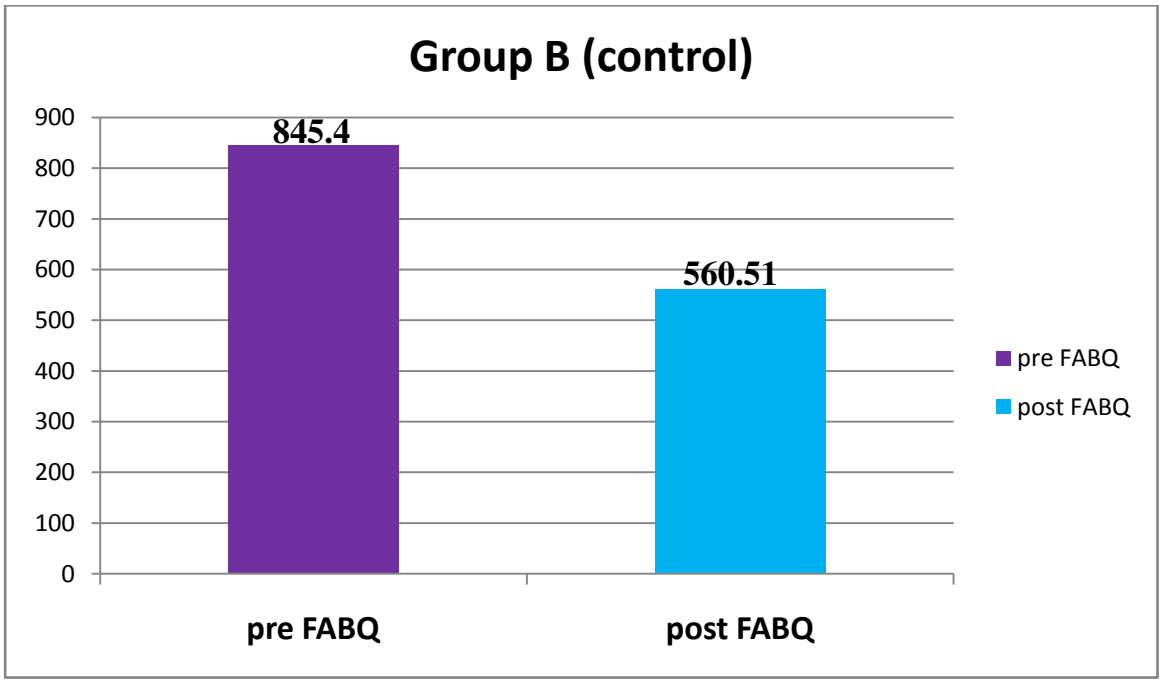
GRAPH- s4.2.3 Mean of pre test and post test values of FABQ of Group A

PAIRED 't' test - FABQ (A)- Experimental group (force couple activation exercises)



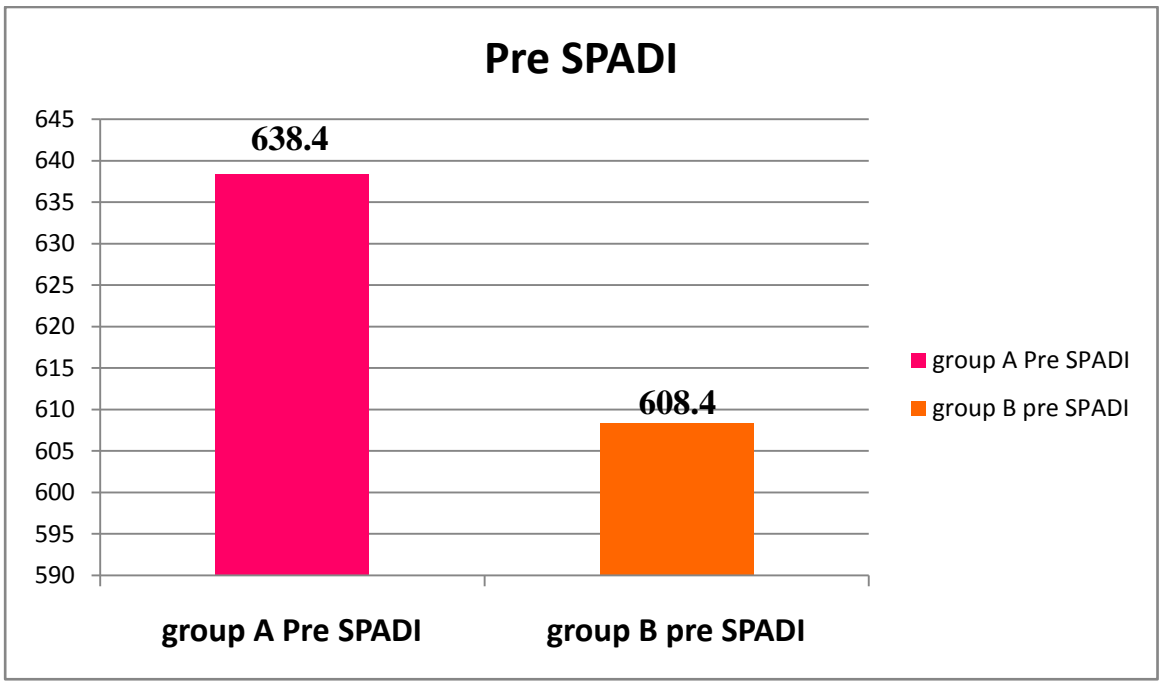
GRAPH- 4.2.4 Mean of pre test and post test values of FABQ of Group B

PAIRED 't' test - FABQ (B)- Control group (conventional exercises)



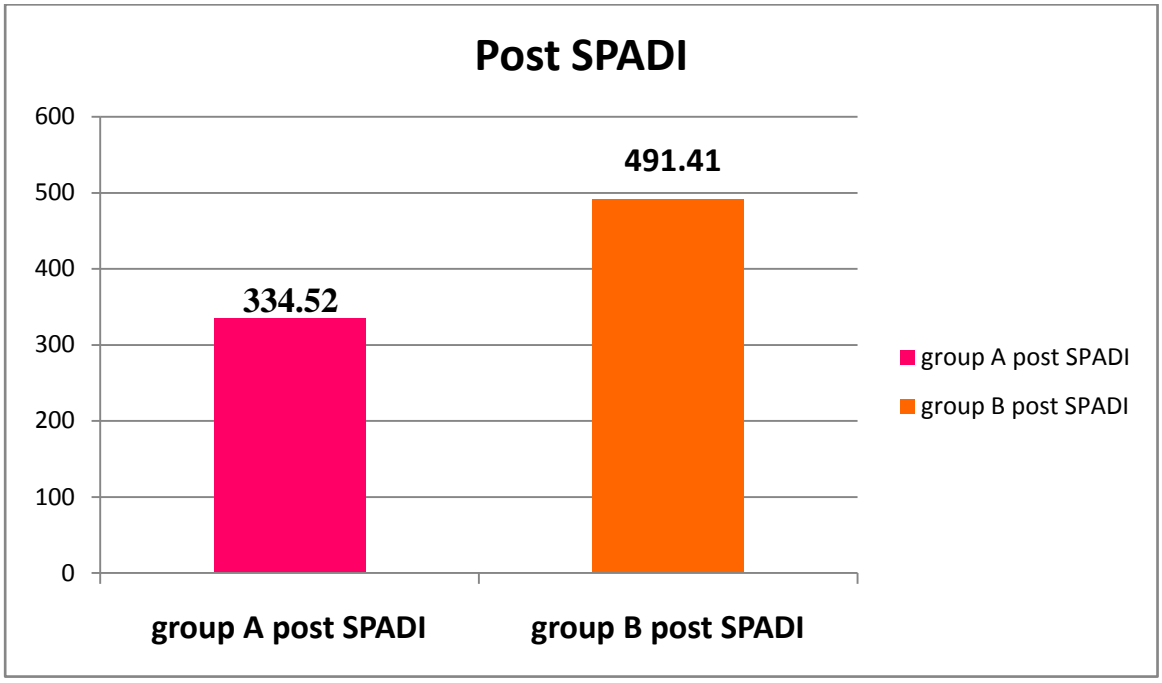
GRAPH- 4.2.5 Mean of pretest values of SPADI of Group A and B

INDEPENDENT 't' test – pretest for SPADI



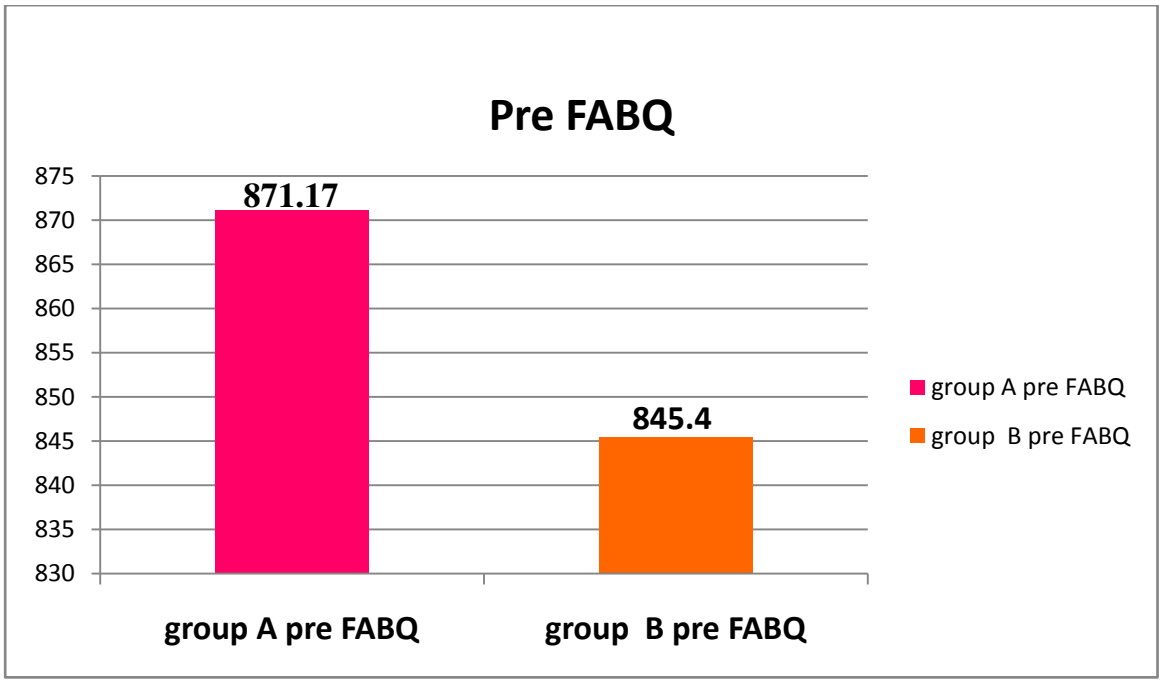
GRAPH-4.2.6 Mean of post test values of SPADI of Group A and B

INDEPENDENT 't' test – post test for SPADI



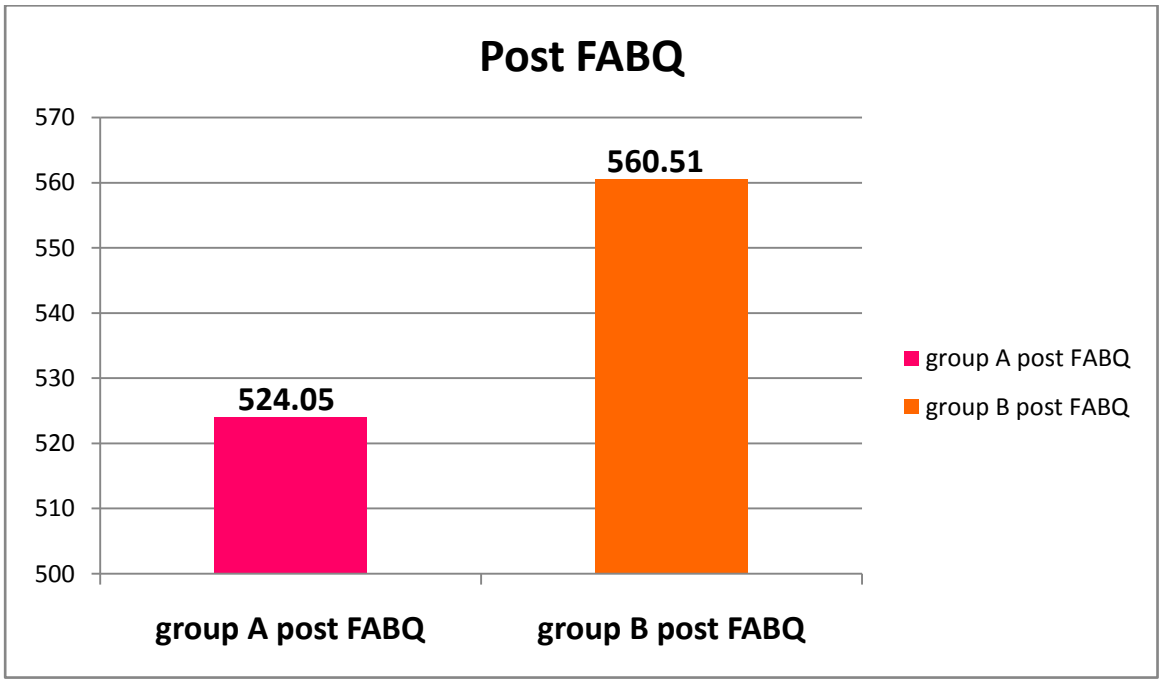
GRAPH- 4.2.7 Mean of pretest values of FABQ of Group A and B

INDEPENDENT 't' test – pretest for FABQ



GRAPH-4.2.8_Mean of post test values of FABQ of Group A and B

INDEPENDENT 't' test – post test for FABQ



5. RESULTS AND DATA ANALYSIS

PAIRED ‘t’ TEST:

(a) SHOULDER PAIN AND DISABILITY INDEX.

Group A [scapular muscle force couple activation exercises]

The pre-test and posttest values of shoulder pain and disability index was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table‘t’ value was 2.145 and the calculated ‘t’ value was 37.67. Since the calculated ‘t’ value was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in shoulder pain and disability index in group A.

Group B [conventional exercises]

The pre-test and posttest values of shoulder pain and disability index was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 14.35. Since the calculated ‘t’ value was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in shoulder pain and disability index in group B.

(b) FEAR AVOIDANCE BELIEF QUESTIONNAIRE.

GroupA[scapular muscle force couple activation exercises]

The pre-test and posttest values of fear avoidance belief questionnaire was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table‘t’ value was 2.145 and the calculated ‘t’ value was 14.47. Since the calculated ‘t’ value was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in fear avoidance belief questionnaire in group A.

Group B [conventional exercises]

The pre-test and posttest values of fear avoidance belief questionnaire was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 10.38. Since the calculated ‘t’ value

was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in fear avoidance belief questionnaire in group B.

INDEPENDENT ‘t’ TEST:

(a) SHOULDER PAIN AND DISABILITY INDEX.

Pre test values:

The pre-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 1.25. Since the calculated ‘t’ value was less than the table‘t’ value null hypothesis was accepted. Hence, there was no significant improvement in shoulder pain and disability index in both group A and B.

Post test values:

The post-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 11.17. Since the calculated ‘t’ value was greater than the table‘t’ value null hypothesis was rejected. Hence, there was significant improvement in shoulder pain and disability index in both group A and B.

(b) FEAR AVOIDANCE BELIEF QUESTIONNAIRE.

Pre test values:

The pre-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 0.68. Since the calculated ‘t’ value was less than the table‘t’ value null hypothesis was accepted. Hence, there was no significant improvement in fear avoidance belief questionnaire in both group A and B.

Post test values:

The post-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 1.61. Since the calculated ‘t’ value was lesser than the

table‘t’ value null hypothesis was accepted. Hence, there was no significant improvement in fear avoidance belief questionnaire in both group A and B.

6. DISCUSSION

Subacromial shoulder impingement syndrome is common in adult populations due to the functional narrowing of the subacromial space. Almost all the patients who exhibits with the shoulder pathology will be associated with the dysrhythmic movement that results in the abnormal scapulohumeral rhythm. Similarly, in the subacromial impingement also, scapular muscle weakness was found. It is not certain whether the poor scapular muscles strength, alters the scapula humeral rhythm and causes excessive tension in the supra spinatus muscle that results in micro trauma and inflammation, or the repetitive over head motions that causes the reduction in the normal space in the coraco acromial arch which affects the normal synchronised movement of the scapula over the thorax.

The purpose of this study was to evaluate the effects of emphasizing scapular muscle force couple activation and conventional exercises in treating scapular dyskinesis in patients with secondary subacromial impingement syndrome. The study mainly focuses on the pain disability, level of fear in the impingement population, where both the experimental and control groups were improved in pain, disability and level of fear but the experimental group showed better results comparatively.

PAIN:

There is a significant improvement in pain in both the experimental and control groups that could be as per the neurophysiologic pain reduction phenomenon which is associated with graded movement. It has been reported that while stimulating the type I and II afferent articular mechanoceptors, reflexogenically reduces the tone and awareness of pain. In contrast the experimental group received additional exercises that mainly concerned with the synchronized motor firing of the serratus anterior, lower trapezius and upper trapezius that plays major role in eliciting normal scapula-humeral rhythm. The repeated movements done by the shoulder joint, along with the continuous stimulation of these muscles, not only results in the regaining of normal range, but also pain reduction due to the reduction in the level of fear and increased confidence levels. The functional exercises that activates the force-couple of scapula and humerus, ultimately resulted in better prognosis in pain reduction.

DISABILITY:

Eventually, both the control and experimental group shows a significant improvement in the disability, the experimental group is beneficial with the effects of added exercises. The scaption plane elevation exercises, D2 flexion pattern exercises improves the over head motions with out pain, where the greater tuberosity is pulled away from the glenoid fossa, at the end range of the over head movements, especially in the scaption plane elevation.

Additionally, the coupling effect is well achieved in the prone lying rowing that continued with the scapular retraction along with the glenohumeral abduction and end range extension. Eerxises thar are done with the closed kinetic chain such as the Lawnmover exercises, robbery exercises provides bilateral effects stimulating the serratus anterior, lower trapezius along with the trunk movements. Squatting during these exercises provides no obvious effect in treating

the scapular dyskinesis in these patients. The disability prognosis found better in experimental group due to the increased and repeated training to the core pathology area that produced compensary action in the shoulder joint.

FEAR:

Recent evidences suggests that a combination of psychological cognitive, environmental and neurophysiological factors in the etiology and maintenance of chronic pain. It has been suggested that fear of pain, and activity driven by the anticipation of pain and increased injury rather than the noxious sensory stimuli associated with pain itself, produces strong negative reinforcement for the persistence of avoidance behavious (Dennis C. Et al). Assessing the level of fear, enables to judge the prognosis of the individual patient. Repeated movements in a particular direction enables the patient to be aware of the movement that should be done and assess the pain that might produce during the movement. The experimental group was targeted with the exercises that focuses on the scapulothoracic and scapulohumeral muscles. As these muscles such as the serratus anterior, lower trapezius, rhoimboids and upper trapezius are stimulated , they are pulled in the normal anatomical pathway that in turn, reduces the pain, incorporates proper range without impinging or damaging the other adjacent structures. To assess the level of fear that associated with the condition, the fear avoidance belief scale is used and found that there is a significant improvement in both the control and experimental groups but no major difference between these 2 groups was obvious.

7. CONCLUSION

The study aimed at finding the effects of emphasizing the scapular muscle force couple activation and conventional exercises to treat scapular dyskinesis in patients with secondary subacromial impingement syndrome, where 30 subjects were recruited in this study and divided into two groups, 15 subjects in Group (A)-force couple activation exercises, and 15 subjects in Group (B)- conventional exercises. Scapular muscle force couple activation exercises were given along with the conventional exercises where as the control group received only conventional exercises.

Pain, disability and level of fear were assessed initially and at the end of the 4th week using the Shoulder Pain and Disability Index (SPADI), and Fear Avoidance Belief Questionnaire (FABQ). The results were analysed statistically by using the independent 't' test and paired 't' test at the 5% level of significance. The experimental group showed significant improvement in the pain and disability but no much differences in the level of fear.

Thus, the result of this study indicates that exercises thar are focuses on treating the scapular dyskinesis along with conventional exercises that targets the glehohumeral motion and muscular strength, in the secondary subacromial impingement syndrome are more effective and statistically signifies in improvement.

8. LIMITATIONS AND SUGGESTIONS

8.1 LIMITATIONS

- The population of the study was too small
- study duration was very less
- criteria for inclusion in this study doesnot use confirmatory test like subacromial steroid injection/ other imaging modalities to rule out the exact structure involved, hence accurate diagnosis remains questionable.
- age group difference was too large in the inclusion criteria
- visual diagnosis of scapular dyskinesis may vary from therapist to therapist

8.2 SUGGESTIONS

- Further studies can be conducted with a large sample size
- longitudinal study and follow-up can be done to see the sustence of effects
- supervised therapy sessions can be organised rather than providing home exercises program to gain constant motivation of the patients
- 3-dimentional movement analysis can be done to find the accuracy of the abnormality in the scapulohumeral rhythm.

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INFORMED CONSENT FORM

I ---------- voluntarily consent to participate in the research study, "EMPHASIZING SCAPULAR MUSCLES FORCE COUPLE ACTIVATION AND CONVENTIONAL EXERCISES TO TREAT SCAPULAR DYSKINESIS IN PATIENTS WITH SECONDARY SUBACROMIAL IMPINGEMENT SYNDROME"

The researcher has explained me the treatment approach in brief, the risk of participation and has answered the question related to the research to my satisfaction.

Signature of participant Signature of the researcher

Signature of the witness

Place:

Date:

ASSESSMENT FORM

Name: Date:

Age: Time:

Gender:

Occupation:

Reffered by:

Chief complaints:

Present medical history:

Past medical history:

Pain history:
Side:
Site:
Onset:
Duration:
Frequency:
Type:
Aggravating factors:
Relieving factors:

ON OBSERVATION:

Body built:
Posture:
Pattern of movement:
Contour of shoulder:
deformity:
Usage of assistive devices:
Tropical changes:

ON PALPATION:

Swelling:
Tenderness:
Warmth:
Tissue texture:
Crepitus:

ON EXAMINATION:

Range of motion

ACTION	RIGHT	LEFT
Flexion		
Extension		
Abduction		
Adduction		
Internal rotation		
External rotation		

MUSCLE POWER:

SHOULDER MUSCLES	RIGHT	LEFT
Flexors		
Extensors		
Abductors		
Adductors		
Internal rotators		
External rotators		

SCAPULAR MUSCLES	RIGHT	LEFT
Elevators		
Depressors		
Protractors		
Retractors		
Upward rotators		
Downward rotators		

Sensation:
Endfeel:
Joint play:
Reflexes:
Gait pattern:

POSTURE ASSESSMENT:

Anterior view:
shoulder blades:

Posterior view:
superior angle of scapulae:
spine of scapulae:
Inferior angle of scapulae:
Medial border prominence:

SPECIAL TESTS:

1. Neer's impingement test:
2. Hawkins kennedy test:
3. Empty can test:
4. Painful arc sign:
5. Scapular assistance test:
6. Scapula reposition test:

CONFIRMATORY DIAGNOSIS:

SHORT TERM GOALS:

LONG TERM GOALS:

ERGONOMIC ADVICES:

Shoulder Pain and Disability Index

Please place a mark on the line that best represents your experience during the last week attributable to your shoulder problem.

Pain scale

How severe is your pain?

Circle the number that best describes your pain where: **0** = no pain and **10** = the worst pain imaginable.

At its worst?	0	1	2	3	4	5	6	7	8	9	10
When lying on the involved side?	0	1	2	3	4	5	6	7	8	9	10
Reaching for something on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Touching the back of your neck?	0	1	2	3	4	5	6	7	8	9	10
Pushing with the involved arm?	0	1	2	3	4	5	6	7	8	9	10

Total pain score _____ /50 x 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, eg. if 1 question missed divide by 40)

Disability scale

How much difficulty do you have?

Circle the number that best describes your experience where: **0** = no difficulty and **10** = so difficult it requires help

Washing your hair?	0	1	2	3	4	5	6	7	8	9	10
Washing your back?	0	1	2	3	4	5	6	7	8	9	10
Putting on an undershirt or jumper?	0	1	2	3	4	5	6	7	8	9	10
Putting on a shirt that buttons down the front?	0	1	2	3	4	5	6	7	8	9	10
Putting on your pants?	0	1	2	3	4	5	6	7	8	9	10
Placing an object on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Carrying a heavy object of 10 pounds (4.5 kilograms)	0	1	2	3	4	5	6	7	8	9	10
Removing something from your back pocket?	0	1	2	3	4	5	6	7	8	9	10

Total disability score: _____/ 80 x 100 =_____ %

(Note: If a person does not answer all questions divide by the total possible score, eg. if 1 question missed divide by 70)

Total Spadi score: _____ 130 x 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, eg if 1 question missed divide by 120)

Minimum Detectable Change (90% confidence) = 13 points
(Change less than this may be attributable to measurement error)

Source: Roach et al. (1991). Development of a shoulder pain and disability index.

Name: _____ Date: _____

Here are some of the things which other patients have told us about their pain. For each statement please circle any number from 0 to 6 to say how much physical activities such as bending, lifting, walking or driving affect or would affect your pain.

	COMPLETELY DISAGREE			UNSURE			COMPLETELY AGREE
1. My pain was caused by physical activity	0	1	2	3	4	5	6
2. Physical activity makes my pain worse	0	1	2	3	4	5	6
3. Physical activity might harm my back	0	1	2	3	4	5	6
4. I should not do physical activities which (might) make my pain worse	0	1	2	3	4	5	6
5. I cannot do physical activities which (might) make my pain worse	0	1	2	3	4	5	6

The following statements are about how your normal work affects or would affect your pain.

	COMPLETELY DISAGREE			UNSURE			COMPLETELY AGREE
6. My pain was caused by my work or by an accident at work	0	1	2	3	4	5	6
7. My work aggravated my pain	0	1	2	3	4	5	6
8. I have a claim for compensation for my pain	0	1	2	3	4	5	6
9. My work is too heavy for me	0	1	2	3	4	5	6
10. My work makes or would make my pain worse	0	1	2	3	4	5	6
11. My work might harm my back	0	1	2	3	4	5	6
12. I should not do my normal work with my present pain	0	1	2	3	4	5	6
13. I cannot do my normal work with my present pain	0	1	2	3	4	5	6
14. I cannot do my normal work until my pain is treated	0	1	2	3	4	5	6
15. I do not think that I will be back to my normal work within 3 months	0	1	2	3	4	5	6
16. I do not think that I will ever be able to go back to that work	0	1	2	3	4	5	6

EXERCISE PAMPHLET

1. cervical side bending (for upper trapezius)

- Positon: standing
- Instructions: Side flex the neck to the opposite side. Rotate the head towards the same side.
- கழுத்தை நேராக வைக்கவும், பின்பு வலது புறமாக சாய்த்தபடியே, இடதுபுறமாக திரும்பி பார்க்கவும். அதே நிலையில் 30 நொடிகள் பிடித்து வைத்து, பின் இடது பக்கம் அதே போல செய்யவும்.

2. Scapular protraction (for rhomboids)

- Position: Sitting
- Instructions: Place the hands crossed over the table. Reach for maximum lateral directions
- முதலில் நேராக நிற்கவும். இரு கைகளையும் கோர்த்து பிடித்து தோல் பட்டை அளவுக்கு உயர்த்தவும். பின்பு கைகளை கோர்தவரே முன்னே தள்ள முயற்சிக்கவும். அதே நிலையில் 30 நொடிகள் பிடித்து வைத்து பின் இளைப்பாறவும்.

3. Shoulder horizontal adduction (for posterior capsule)

- Position: standing
- Instructions: bring the arm cross to the body. Use the other hand to apply over pressure, pulling the elbow
- முதலில் நேராக நிற்கவும். வலது கையால் இடது முதுகை தொட முயற்சிதவாறே இடது கையால் வலது கை மேல் அழுத்தம் தரவும். அவ்வாறே 30 நொடிகள் பிடித்து வைக்கவும்.

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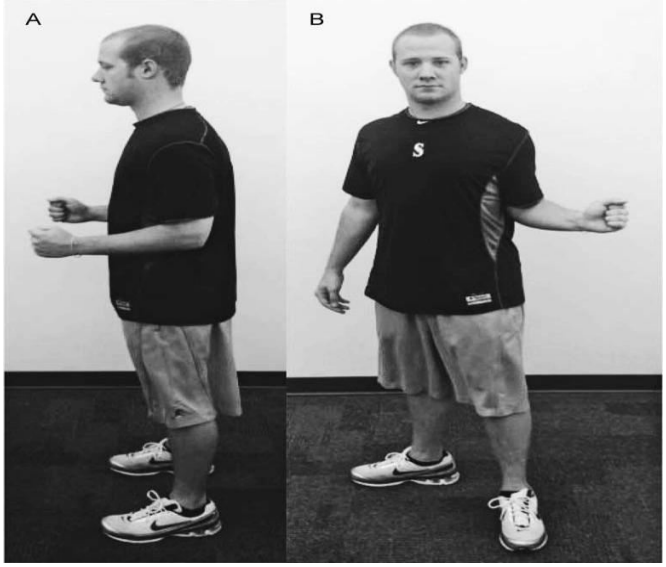
4. Shoulder horizontal abduction (for pectoralis major)

- Position: Stand over a corner of the wall
- Instructions: place the hands over the wall with the chest inbetween the hands and propel the chest forward with feets stable on the ground.
- ஒரு செவுற்றின் மூலையில் இரு கைகளையும் செவிற்றின் மேல் வைத்து நேராக நிற்கவும். பின்பு மெதுவாக உடம்பை முன்னே தள்ளவும். அவ்வாறே 30 நொடிகள் பிடித்து வைத்து, பின் இளைப்பாறவும்.

5. Bow and Arrow exercise

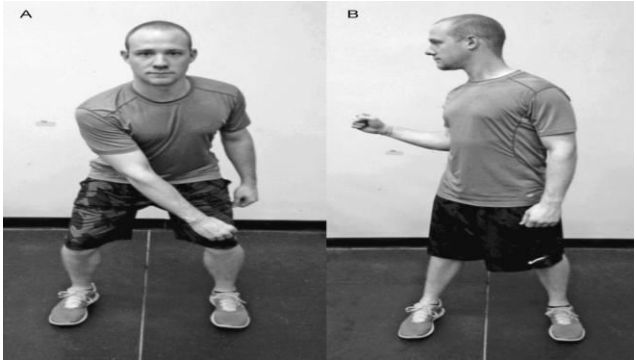
- Position: Standing
- Instruction: Raise the arm upto shoulder level. Pull one of the hand behind and other hand with extended position and vice versa
- முதலில் நேராக நிற்கவும். பின்பு வில் அம்பு விடுவது போல படத்தில் உள்ள படி நிற்கவும். பின்பு அதே போல மற்றொரு கையிலும் செய்யவும்.

6. External rotation with scapular squeeze exercise



- Position: Standing
- Instruction: Flex your elbow with fisting. Move the hand in the outer direction. Do it alternatively in both hands
- முதலில் நேராக நிற்கவும். இரு கைகளையும் படத்தில் உள்ளவாறு மடக்கவும். பின்பு கைகளை உடம்போடு ஒட்டியபடியே மணிக்கட்டை வெளிப்புறமாக கொண்டு செல்லவும்.

7. Lawnmower exercise

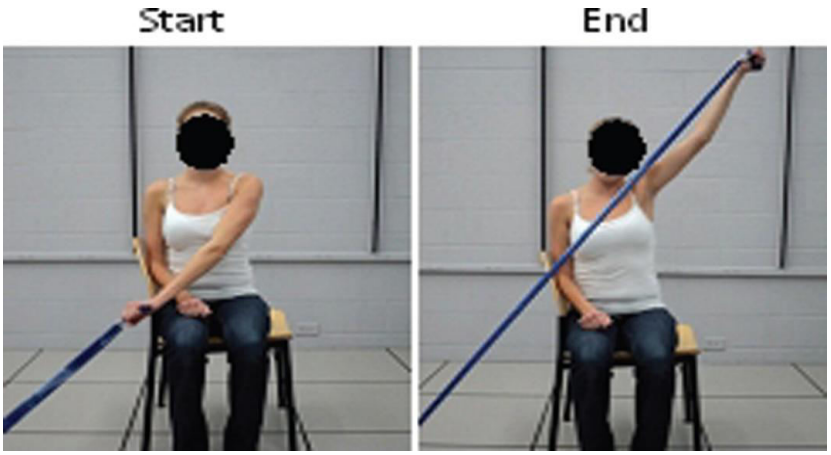


- Position: Standing
- Instruction: Flex your elbow with fisting. Extend it by using the body with bending then trunk forward. Bring back the hand to flexed position by twisting the trunk. Do alternatively in both hands.
- முதலில் நேராக நிற்கவும். வலது கையை மடக்கியவாறே பின் நோக்கி பார்க்கவும். பின்பு முன்னே திரும்பியவாறே வலது கையால் இடது கால் மூட்டை தொடுவது போல கால் முட்டிகளை மடக்கி தொட முயற்சிக்கவும்.

8. Robbery exercise

- Position: Standing
- Instruction: Flex your elbow with shoulders retracted. Extend it infront of your body with bending the trunk forward along with semi squatting. Bring back the hands to flex position with erect standing.
- நேராக நின்றவரே இரு கைகளையும் உடம்போடு ஒட்டி வைத்து மடக்கி பிடிக்கவும். பின்பு கால் முட்டிகளை மடக்கி உட்கார முயற்சிதவாறே இரு கைகளையும் கால் முட்டிக்கு நேராக நீட்டவும்.

9. D2 flexion pattern exercise

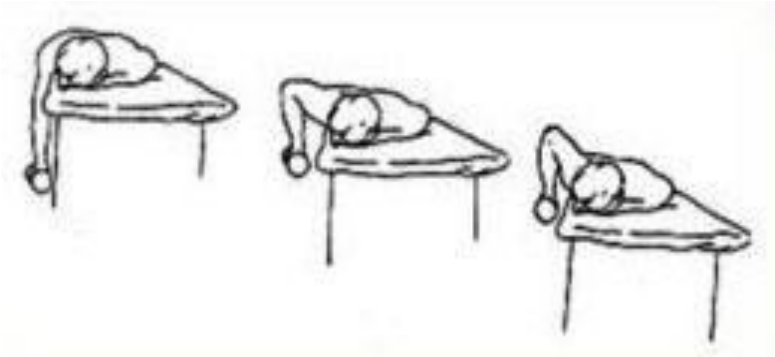


- Position: Standing
- Instruction: Bring the arm to the opposite side lower end. Make a cross movement by taking it to the same side upper end. Do it alternatively
- முதலில் நேராக நிற்கவும். பின்பு வலது கையால் இடது பக்க இடுபளவில் இருந்து மேல் நோக்கி வலது புறமாக ஒரு கோடு போல கையை கொண்டு செல்லவும். அதே போல மற்றொரு கையிலும் செய்யவும்.

10. Scaption plane elevation

- Position: Standing
- Instruction: Flex the arm forward wih palms facing towards the opposite palm. Raise the arm upto the maximum level. Do it alternatively
- முதலில் நேராக நிற்கவும். பின்பு இரு உள்ளங்கைகளை பார்த்தவாறு உள்நோக்கி வைத்தவரே மேலே உயர்த்தவும்.

11.Prone lying rowing

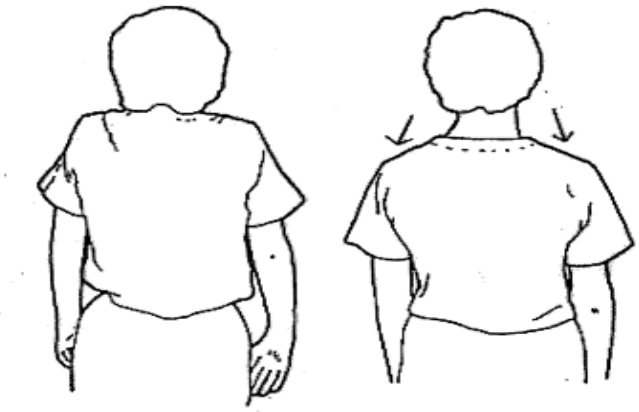


- Position: Prone lying
- Instruction: Lye down at the edge of the couch. Hang down the treatment hand at the edge. Now pull the hand from down to up with shoulders retracted.
- தலை குப்புற மெத்தையின் விளிம்பில் படுக்கவும். வலது கையை கீழே தொங்கிய படி விடவும். பின்பு கையிற்றை இழுப்பதை போல அதே நிலையில் இருந்து செய்யவும்.

12.Codman's pendular exercise

- Position: Stooped standing
- Instruction: Bend down with the arm hanging freely. Make small-large circles with the hand in clock-wise and anti-Clockwise directions.
- படத்தில் உள்ளவாறு ஒரு மேஜையின் மீது கை வைத்து கொண்டு கீழே குனியவும் பின்பு மற்றொரு கையால் சிறிய வட்டங்களை போடவும். பின்பு மாற்று திசையிலும் சுற்றவும்.

13.Shoulder shrugging exercises



- Position: Standing
- Instruction: Leave the arm free and relaxed. Try to pull the shoulder blades to touch the ears and then relax
- முதலில் நேராக நிற்கவும். பின்பு தோல் பட்டையை காதருகே படத்தில் உள்ளவாறு கொண்டு செல்லவும்

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14.Seated dips

- Position: Sitting
- Instructions: Hold the arm rest of the chair. Try to get down from the chair without taking the hands off from it
- ஒரு நாற்காலியில் நேராக அமரவும். கைகளால் நாற்காலியின் கைபிடியை இருக்கபிடித்து எழுந்திரிக்கவும். பின்பு மெதுவாக ஒரு அடி முன்னே சென்று கைபிடியை பிடித்தவாறே படத்தில் உள்ளவாறு கீழே அமர முயற்சித்து பின் எழவும்.